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The Great Basin Naturalist

Volume II, 1941

VASCO M. TANNER, Editor

Published at Provo, Utah, by
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Vasco M. Tanner, *Editor*

C. Lynn Hayward, *Assistant Editor*

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Volume II FEBRUARY 20, 1941 No. 1

NOTES ON THE NESTING HABITS OF SOME MOUNTAIN DWELLING BIRDS IN UTAH[1]

C. LYNN HAYWARD
Assistant Professor of Zoology, Brigham Young University

In the course of field work in mountainous portions of Utah during the past few years the writer has had occasion to take note of nesting activities of some of the birds of these higher elevations. These observations have been made mostly on Mt. Timpanogos, Utah County, and on the west end of the Uinta Mountains, Wasatch County, at elevations of 7,000 feet and above. Although the material contained herein is fragmentary it is hoped that it will throw some light upon a subject that is little known.

Sphyrapicus varius nuchalis Baird. Red-naped Sapsucker

The breeding of this species occurs mostly in mature aspen woods, but a few individuals may occasionally frequent coniferous forests. On April 5, 1940 at Aspen Grove, Mt. Timpanogos, a pair was seen preparing for mating. The male was seen to follow the female closely from tree to tree, uttering series of sharp notes and erecting the crown feathers. No actual copulation was noted at this time. June 12, 1934 a nest was noted in a dead aspen fourteen feet from the ground at Mule Flat, two miles north of Aspen Grove, Mt. Timpanogos. Both parents were seen to carry in food. On June 21, 1937 two nests were noted at Aspen Grove and two at Mule Flat, Mt. Timpanogos. They were situated in dead aspens fifteen to twenty feet from the ground. In all cases young birds could be heard in the nests.

(1) Contribution No. 87, Dept. of Zoology and Entomology, Brigham Young University.

PICOIDES TRIDACTYLUS DORSALIS Baird. Alpine Three-toed Woodpecker

In my studies thus far this woodpecker has been found only in the densely wooded subalpine forests of the Uinta Mountains. On July 9, 1930 a nest containing young was found at Tryol Lake, Wasatch County, elevation about 9,900 feet. This nest was located in a dead Lodgepole Pine about ten feet from the ground. A hole about two inches in diameter formed the entrance to the nest, and, extending down the center of the trunk a distance of about twelve inches below the entrance, a hollow four inches in diameter had been formed. The nest was located at the bottom of this hollow.

On July 12 the female was found dead at the foot of the tree but the male continued to feed the young until July 14 when he was collected. At the time the male was collected the two young were removed from the nest and made into skins. They were both males and appeared to be about two-thirds grown (wing 82 mm. as compared to 120 mm. in the adult). July 21 of the same year another nest containing young and similarly constructed was located about fifteen feet up in the stump of a dead Engelmann Spruce.

EMPIDONAX HAMMONDI (Xantus). Hammond's Flycatcher

This species and Wright's Flycatcher *Empidonax wrighti* Baird are extremely difficult to distinguish from one another in the field and for this reason the following notes are recorded with some misgivings. Both species are found on Mt. Timpanogos, but our collections thus far indicate that *E. hammondi* is confined largely to aspen and conifer woods, while *E. wrighti* occupies chaparral. However, the two undoubtedly occur together at least at the edges of the woods. A set of four eggs of *E. hammondi* was collected by James Bee at Aspen Grove, Mt. Timpanogos, June 23, 1937. The nest was located in an aspen, but details of its construction are lacking. On July 11, 1937 a pair presumably of this species was seen constructing a nest about twenty feet up on a dead limb of an aspen near the summit of Loop Road, Mt. Timpanogos. This nest was composed largely of fine plant fibers.

EMPIDONAX WRIGHTI Baird. Wright's Flycatcher

The only rather positive nesting record of this species available from my notes is that of June 6, 1940 when a nest was discovered on a chaparral covered hillside directly east of Big Tree Camp, Mt. Timpanogos. This nest was situated in a small oak *Quercus gambellii* about two and a half feet from the ground. It was composed mainly of plant fibers, neatly and compactly woven and was lined with a few

feathers. Behaving in characteristic fashion the birds remained for the most part hidden in the brush appearing only at intervals for brief periods and occasionally uttering sharp chirps of alarm.

EMPIDONAX DIFFICILIS DIFFICILIS Baird. Western Flycatcher

The nesting activities of this species have been noted on Mt. Timpanogos in the vicinity of Lower Falls, Aspen Grove. On June 26, 1937 two nests about 100 yards apart were found on the north-facing cliffs near Lower Falls. They were situated in crevices about six feet up from the base of the cliffs. One of the nests contained four fresh eggs and the other five. In both cases there was water dripping over the nests and the materials of which they were composed were soaking wet. The nests were composed of fine grass covered with green moss and lichens like the surrounding rocks. The birds were extremely shy and it was with considerable difficulty that I was able to make the identifications.

TACHYCINETA THALASSINA LEPIDA Mearns. Violet-green Swallow

This species breeds quite commonly in certain portions of mature aspen forests on Mt. Timpanogos. All of my observations were made at Mule Flat about two miles north of Aspen Grove. On June 21, 1936 John Hutchings and the writer opened up a nest in a live aspen about six feet from the ground. In spite of the noise incident to opening the nests the female refused to leave until plucked off by hand. The nest contained only two fresh eggs. A year later on the same date and in the same locality females were observed carrying material into holes, and there was evidence of at least four or five nests within a half acre area. In this connection Violet-green Swallows were occasionally seen fighting with Tree Swallows over nesting sites. On July 3, 1937 a nest was opened which contained four eggs nearly ready to hatch.

IRIDOPROCNE BICOLOR (Vieillot). Tree Swallow

The nesting habits of this species are similar to those of the Violet-green Swallow described above. The two species frequently nest in the same tree. A nest opened on July 3, 1937 at Mule Flat, contained four newly hatched young. This nest was in a dead aspen about twenty feet from the ground. However, like the Violet-green, this species frequently nests in living trees.

PROGNE SUBIS SUBIS (Linnaeus). Purple Martin

Like the swallows described above the Purple Martin nests in mature aspen forests on Mt. Timpanogos and is often seen in company

with the swallows. At Mule Flat on June 21, 1937 we saw females leave and enter two different holes in the same trees. At this same time males were seen to carry green aspen leaves into the nests. These leaves, we found later, were used as a lining and are apparently continuously replaced by fresh ones throughout the incubation period. On July 3, we opened two of these nests. One situated in a partially dead aspen about thirty feet from the ground contained three newly hatched young. The other, located twenty feet up in a dead aspen stump contained four eggs nearly ready to hatch.

Hylocichla guttata auduboni (Baird). Audubon's Hermit Thrush

The nests of this species have been encountered rather frequently on Mt. Timpanogos. They are generally placed rather low in conifers, aspens, or in brush along streams and at the edges of forests. The following nesting data are available from my notes: A nest containing six fresh eggs was taken from an aspen fork twelve feet from the ground at Salamander Lake, Mt. Timpanogos, June 5, 1937. Another nest containing three newly hatched young and one unhatched egg was observed in a choke cherry bush at Aspen Grove, June 19, 1937. This nest was about three feet from the ground. The outside shell was composed of bark and the inner lining consisted of fine roots. Mr. R. G. Bee has supplied me with a record of four fresh eggs taken in South Fork of Provo Canyon, June 5, 1929. On July 9, 1940 a nest containing four half-grown young was found at Big Tree Camp, Mt. Timpanogos in the top of a small white fir, five feet from the ground. On the ridge immediately to the west of Aspen Grove, a nest was found in the forks of an aspen tree six feet from the ground, June 14, 1940. It contained four eggs just in the process of hatching.

Myadestes townsendi (Audubon). Townsend's Solitaire

On June 24, 1937 Mr. Merlin Killpack discovered a nest of this species near Lower Falls west of Aspen Grove, Mt. Timpanogos. It was situated in a niche on a cliff about seven feet up from the base. The outer shell of the nest was composed of rather large dry twigs while the inside was lined with fine grass. There were four well incubated eggs. Both the bird and the eggs were collected. Water was dripping from overhanging rocks in front of the nest but the nest itself was dry. Another similarly constructed nest was found on June 29 only about one hundred yards from the first one. It likewise contained four well incubated eggs. A third nest presumably of this species was located about six feet up in a small white fir at Aspen

Grove, Mt. Timpanogos, June 19, 1937. The young had left or been removed from this nest and only fragments of the shells and general structure of the nest indicated its identity.

ANTHUS SPINOLETTA RUBESCENS (Tunstall). American Pipit
(Pl. I, Fig. 2)

A nest containing four fresh eggs was found at Lost Lake, Uinta Mountains, June 19, 1940, elevation 9,800 feet. It was situated in a rather dry subalpine meadow. The rim of the nest was flush with the surrounding surface of the ground, and the cup was sunken into the sod to a depth of about three inches. The nest was lined with very fine, dry grass. Even though incubation had not begun, the bird sat very close and allowed one to come within two feet or less without leaving the nest. If the observer withdrew fifty feet from the nest site, the bird would return immediately and settle on the eggs. The bird was so fearless that I was able to set up the camera within two feet of the nest and approach close enough to trip the shutter without startling her. Only one bird was seen at any time in the vicinity of the nest.

VIREO GILVUS SWAINSONI Baird. Western Warbling Vireo
(Pl. I, Fig. 5)

The nesting of this species has been observed at Aspen Grove and Mule Flat on Mt. Timpanogos. My notes indicate that the birds confine themselves almost entirely to deciduous woods which at that altitude are chiefly aspens. Although vireos feed generally in the tops of the trees, the nests that we have observed have been low—generally four to eight feet from the ground. The nests were placed between two small forks well out on aspen limbs. They were composed of fine grass compactly formed, and were bound together, and to the branches, with cobwebs. At Aspen Grove a nest containing four incubating eggs was located on June 19, 1937. June 23 these eggs had hatched. Another nest, containing four eggs, was found at Mule Flat, two miles north of Aspen Grove on June 21, 1937. When the nest was again visited on July 3 the eggs had not yet hatched. On June 6, 1940 a pair of vireos was observed constructing a nest at Big Tree Camp, Mt. Timpanogos.

DENDROICA AUDUBONI MEMORABILIS Oberholser. Rocky Mountain Audubon Warbler

These warblers are found commonly in both deciduous and coniferous woods and undoubtedly breed in both places. All of the nest-

ing activities that we have observed, however, have been in the aspen forests. On June 21, 1937 two nests were located at Mule Flat, Mt. Timpanogos. Both were rather far out on aspen limbs and about twenty feet up from the ground. They were composed of fine plant fibers and lined with a few horsehairs and feathers. One nest contained four, the other five fresh eggs. On June 5, 1940 another nest was discovered on an aspen limb about fifteen feet up and next to the trunk. The female was very active about the nest and was seen to carry food to the young. A nest containing young was found near Aspen Grove on June 14, 1940. It was located in the forks of an aspen about twenty feet up. When flushed from the nest the female did a characteristic "tumbling act" and then moved excitedly about in the tree uttering sharp chirps. Young birds could be heard in the nest but no further investigation was made.

Oporornis tolmiei (Townsend). Macgillivray's Warbler
(Pl. I, Fig. 7)

This species occurs rather commonly in the chaparral and forest edge on Mt. Timpanogos, but only one definite nesting record is available from my notes. On June 24, 1937 Mr. Merlin Killpack discovered a nest in the chaparral directly east of Aspen Grove, and the site was subsequently visited by the writer. The nest was situated in a small ninebark about three feet from the ground and was loosely constructed of dried plant stems and lined with very fine grass. It contained four fresh eggs on this date. The female was extremely shy and remained quietly hidden in the underbrush while the nest was being photographed.

Carpodacus cassini Baird. Cassin's Purple Finch

The Purple Finch occurs quite regularly throughout the wooded portion of Mt. Timpanogos and the Uintas, but only one nest has been observed. This nest was discovered at Big Tree Camp, Mt. Timpanogos, June 3, 1940. It was situated about a foot from the top of a slender white fir about twenty-five feet from the ground. It was plainly visible from below and my attention was attracted to it by a peculiar chipping sound produced by the female as she sat on the eggs. The only means of access to it was a nearby aspen from which the contents and something of the construction could be made out. The nest appeared quite flimsy and was composed of dried grass and other vegetation. Four eggs were in the nest at the time it was observed. Sticks thrown up into the nesting tree failed to dislodge the

female, but as I climbed up the nearby aspen she left the nest and remained close at hand uttering throaty chirps. The male did not appear at this time. This nest was kept under observation for about four days. During this time, the female only was seen to incubate the eggs. At 6:30 A.M. on June 4 the female was away from the nest, but appeared within five minutes with the male. In the vicinity of the nest the male made an unsuccessful attempt at copulation.

Oberholseria chlorura (Audubon). Green-tailed Towhee
(Pl. I, Fig. 1)

This species breeds in the chaparral at lower elevations on Mt. Timpanogos. On May 22, 1937 a nest containing four fresh eggs was found on the west face of Timpanogos between Dry and Battle Creek Canyons. It was situated on the ground in a clump of stunted oak and sage and was composed of sage bark, fine grass and a few horsehairs. On June 24, 1937 another nest was discovered at Aspen Grove, Mt. Timpanogos. It was built in a dense clump of choke-cherry about two feet from the ground and contained three partially incubated eggs.

Junco caniceps (Woodhouse). Gray-headed Junco (Pl. I, Fig. 6)

The Gray-headed Junco is a common breeding bird at forest edges and in deeper woods on Mt. Timpanogos and in the Uintas. The nest is placed on the ground in a deep depression lined with fine grass. The location is often such that there is some protection from above. For example one was placed under an overhanging bank near a small stream, several have been found in the midst of stunted shrubs, another was placed under the end of a fallen log, and still another was built in the middle of a pile of dead conifer branches used by some camper as a bed. The following breeding records are available from my notes: Tryol Lake, Uinta Mts. July 19, 1930, nest and four fresh eggs; Lost Lake, Uinta Mts. June 18, 1940, nest and five fresh eggs; Lost Lake, June 19, 1940, nest and four eggs nearly ready to hatch; Lost Lake, July 18, 1940 nest and four fresh eggs; Elk Park, east end of Uinta Mountains July 28, 1937, two nests containing newly hatched young; Aspen Grove, Mt. Timpanogos, June 25, 1933, nest and four fresh eggs (R. G. Bee); Geyser Pass, La Sal Mts. July 17, 1934, nest containing three newly hatched young and one egg. The breeding of these juncos appears to be less regular than most mountainous birds or else more than one brood is produced in a season. In July it is not uncommon to see young in all stages of growth and to find nests and eggs as indicated above.

Spizella passerina arizonae Coues. Western Chipping Sparrow

In the mountains, the nests of these common sparrows have inevitably been found in conifers, although I have evidence that they may also nest in deciduous trees. The nests that have come under my observation have been placed rather low (three to ten feet from the ground) well out on a limb and protected from above by an overhanging branch. The nest is constructed of fine plant fibers, mostly grass, and lined with horsehairs. The following breeding records may be given at this time: Aspen Grove, Mt. Timpanogos, May 17, 1940, nest under construction; Aspen Grove, June 3, 1940, the same nest noted above contained four eggs. (When this nest was observed again on June 11, four half-grown young were there.) Big Tree Camp, Mt. Timpanogos, June 3, 1940 nest and four well incubated eggs. These eggs hatched on June 7. Aspen Grove June 13, 1937, nest containing newly hatched young; Aspen Grove, June 19, 1937 nest containing four nearly grown young; Lost Lake, Uinta Mts. July 17, 1940, nest containing four newly hatched young. This could have been a second brood.

Zonotrichia leucophrys leucophrys (Forster). White-crowned Sparrow (Pl. I, Fig. 4)

This species breeds commonly in subalpine forests on Mt. Timpanogos and in the Uintas. It frequents the edges of the woods and the open parks. The nests that we have discovered have been placed on the ground in a deep depression lined with fine grass. The following breeding records are available: Tryol Lake, Uinta Mts. July 16, 1930 nest containing two eggs; Tryol Lake, July 19, 1930, nest and four eggs, also two nests containing newly hatched young; Lost Lake, Uinta Mts. July 17, 1940, nest containing five partly incubated eggs.

Melospiza lincolni lincolni (Audubon). Lincoln's Sparrow

This species breeds rather commonly in swampy areas and along streams throughout the mountains. However, only two nests have been under observation. These were placed on the ground on grassy hummocks in boggy ground. Both nests were discovered June 20, 1937 at Camp Timpooneke, Mt. Timpanogos. They were deep depressions in the sod lined with fine dry grass and sedges. One contained four, the other two fresh eggs.

Nesting Habits of Mt. Birds

By C. L. Hayward

Fig. 1. Oberholseria chlorura

Fig. 2
Anthus s. rubescens

Fig. 5. Vireo g. swainsoni

Fig. 3
Melospiza l. lincolni

Fig. 4
Zonotrichia l. leucophrys

Fig. 6
Junco caniceps

Fig. 7. Oporornis tolmiei

PLATE I

AN ANNOTATED LIST OF MAMMALS COLLECTED IN NUEVO LEON, MEXICO, IN 1938[1]

E. J. KOESTNER
University of Illinois

The writer spent the summer of 1938 making an ecological study on the 3800 meter (12,500 ft.) mountain, Cerro Potosí, located about 65 kilometers (40 miles) west of Linares in the Municipio de Galeana, Nuevo Leon, Mexico. The study was primarily one of the animal communities of the upper regions of this mountain which is the highest point of the Sierra Madre Occidental range. The communities studied in detail were in the following cover types: (1) alpine grassland, (2) scrub piñon pine (an undescribed species), and (3) pine forest (*Pinus Montezumae* Lindl. var. *Hartwegii* Engelm.). Muller (1937, 1939) has given accounts of the vegetation of the area.

The results of the main portion of this investigation will appear elsewhere. The mammals were also collected in places other than the areas named, and in view of the limited data available on distribution of Mexican mammals in general, it is deemed pertinent that there be given an annotated list of all mammals taken. All localities were taken from maps issued by the Departamento Geografico, Departamento Forestal y de Caza y Pesca, Mexico, D. F. A number of skins was secured from natives from which data were lacking or unreliable so that identifications were not feasible. Among these were bear, raccoon, coyote, mountain lion, and bobcat. Tracks and other signs of all these were also seen but no specimens secured. The list follows that of Miller (1924) with both scientific and common names given. The majority of the specimens are deposited in the Field Museum of Natural History.

The writer wishes to express his appreciation to Dr. C. C. Sanborn of the Field Museum of Natural History and Dr. E. A. Goldman of the Biological Survey for identification of the mammals. He is also indebted to Señor Juan Zinzer, Departamento Forestal y de Caza Pesca, Mexico, D. F., for permission to collect in Mexico.

(1) Contribution from the Zoological Laboratory of the University of Illinois, No. 567.

Sorex emarginatus Jackson. Zacatecas Shrew

Locality: Cerro Potosí, Municipio de Galeana, N. L.
Habitat: Scrub piñon pine.

This supposedly rare shrew was taken only in the scrub pine at about 12,000 feet altitude. The fact that five specimens were taken in an area .07 hectare (.18 acre) in eight days indicates that the animal is abundant in the habitat in which it occurs. Jackson (1928) states that it is known only from Sierra Madre near Bolanos, Jalisco, and Plateado, Zacatecas, Mexico, thus a considerable extension of its range is established. A female taken on July 6 showed evidence of having suckled young. Because of the small size of this shrew two specimens were caught by the tail, the guillotine trap having cleared the rest of the animal. They were dead in both cases, probably due to shock and lack of food. Measurements for the five specimens are given in millimeters in the following respective order: total length, tail length, and hind foot. ♂ 94 - 38 - 12; ♂ 103 - 44 - 12; ♀ 100.5 - 42 - 11; ♀ 95 - 42 - 11; ♀ 91 - 42 - 11.

Leptonycteris nivalis (Saussure). Leaf-nosed bat. "Murcielago".

Locality: Cerro Potosí, Municipio de Galeana, N. L.
Habitat: Cave.

More than a hundred specimens of this species were taken from an abandoned mine near La Joha, (altitude 11,500 ft.) by means of paddles with which they were swatted down as they flew. The mine harbored at least 10,000 bats, all of this species. There was no evidence of the supposed ability of bats to dodge objects as the number collected was secured in a very short time. It is interesting to note that, although the bats spent the day in this cave, none were observed flying at night at these altitudes. The absence of night-flying insects probably compels them to feed at lower altitudes where bats of undetermined species were seen frequently at night.

Eptesicus fuscus (Beauvois). Big brown bat. "Murcielago".

Locality: La Placeta, Municipio de Galeana, N. L.
Habitat: Deciduous forest.

One specimen was taken under bark of a rotten stump in oak forest at 9,000 ft. altitude on August 16. Bats were observed flying at this and lower altitudes.

Conepatus pediculus Merriam. Hog-nosed skunk. "Zorilla".

Locality: San Juan, Municipio de Galeana, N. L.

HABITAT: Chaparral.

One specimen was found after having been killed by natives, but was in too poor a condition for preservation. It was common in this region.

CITELLUS VARIEGATUS COUCHII (Baird). Couch's rock squirrel. "Tusa".

LOCALITY: Ojo de Agua, San Francisco, and Galeana, Municipio de Galeana, N. L.

HABITAT: Rocky cliffs and chaparral.

These ground squirrels were found to be very abundant in the cliffs and dry regions of the lower altitudes (5,500 ft.). All those observed were totally or partially melanistic. Although a ground squirrel, they frequently climb small trees and give forth their chattering call. They are much detested by the natives since their great abundance exerts havoc on their small corn fields. These animals are quite edible, being equal or superior to regular tree squirrels in quality.

CYNOMYS MEXICANUS Merriam. Mexican prairie dog.

LOCALITY: San Juan and Potosí, Municipio de Galeana, N. L.

HABITAT: Desert prairie.

One specimen was taken at S. Juan where the animals were very numerous. Holes occurred every 25 feet on the average. Although the writer did not visit the place, their presence is also established in the valley of Potosí as substantiated by the natives and a skull brought from there.

SCIURUS ALLENI Nelson. Grey squirrel. "Ardilla".

LOCALITY: Ojo de Agua and Cerro Potosí, Municipio de Galeana, N. L.

HABITAT: Pine and deciduous forest.

This squirrel was found ranging throughout the forests, both deciduous and coniferous, occurring from the lower elevations to the limit of trees on Cerro Potosí.

THOMOMYS SPP. Pocket gopher.

LOCALITY: Cerro Potosí and Ojo de Agua, Municipio de Galeana, N. L.

HABITAT: Pine forest and cultivated fields.

Of two species of pocket gophers (undetermined because of insufficient material), one taken at the upper limits of pine on Cerro Potosí (11,000 ft.) was a greyish color. The other taken at Ojo de Agua

was black. The 'pocket' of the latter contained several wheat straws and some *Amaranthus* or pig weed leaves.

LIOMYS IRRORATUS ALLENI (Coues). Allen spiny pocket mouse. "Ratón".

LOCALITY: Ojo de Agua and San Francisco, Municipio de Galeana, N. L.

HABITAT: Rocky valley.

Two specimens were taken, one caught by a boy in a native house during the day. The other, a female, was taken in a trap in a rocky valley near Ojo de Agua and had five early stage embryos.

REITHRODONTOMYS FULVESCENS TENUIS Allen. Mexican harvest mouse. "Ratón".

LOCALITY: Ojo de Agua, Municipio de Galeana, N. L.

HABITAT: Chaparral.

The only record for this species is in the higher areas of this valley. The specimen was taken by native boys while collecting lizards.

PEROMYSCUS MANICULATUS LABECULA Elliot. White-footed mouse. "Ratón".

LOCALITY: Cerro Potosí, Cieneguillas, and Ojo de Agua, Municipio de Galeana, N. L.

HABITAT: Alpine grassland, scrub piñon pine, pine forest, and chaparral.

This was the most abundant animal encountered. It occurred in all types of habitat found and ranged to the highest peak of Cerro Potosí. It was also frequently found in native houses along with other species. Shells of the snail, *Humboldtiana fortis* Pilsbry, broken open on the side were found in places which indicated this species as well as *Microtus mexicanus* fed on them. Although *P. maniculatus labecula* occurred in the same areas with *M. mexicanus*, and both in large numbers, their general activity periods alternated which enabled them to occupy the same areas with a minimum of competition between the species. *M. mexicanus* was most active during the day while *P. maniculatus labecula* was most active at night.

PEROMYSCUS BOYLII LEVIPES (Merriam). White-footed mouse. "Ratón".

LOCALITY: Near Hacienda Villa Hermosa, Municipio Villa de Santiago, N. L.

HABITAT: Pine forest, scrub oak.

Only four specimens were taken, three in a pine forest not far from Monterrey. These were taken on a passing trip so that little is known of their abundance. Another was taken in scrub oak. They are well represented in collections from this and other mountainous regions.

PEROMYSCUS DIFFICILIS (Allen). White-footed mouse. "Ratón".

LOCALITY: Cerro Potosí and Ojo de Agua, Municipio de Galeana, N. L.

HABITAT: Scrub piñon pine, pine forest, chaparral.

This large mouse was conspicuous because of its size although compared to others was much less abundant, there being 20 *Peromyscus maniculatis labecula* to every *P. difficilis*. It was taken in the same variety of habitats as *P. maniculatus labecula* and was a more serious pest in native houses than others, probably because of its size. The walls of the adobe houses were a maze of tunnels made by this species.

NEOTOMA ALBIGULA LEUCODON Merriam. White-toothed wood rat. "Rata".

LOCALITY: Ojo de Agua, Municipio de Galeana, N. L.

HABITAT: Rocky cliffs near cultivated areas.

The white-toothed wood rat was taken in the rocky valley and seen frequently around camp and near structures of a saw mill, since they were active during the day as well as at night.

MICROTUS MEXICANUS (De Saussure). Mexican vole. "Ratón".

LOCALITY: Cerro Potosí, Cieneguillas, and Ojo de Agua, Municipio de Galeana, N. L.

HABITAT: Alpine grassland, scrub piñon pine, chaparral.

The Mexican meadow mouse is another widespread species in the area of most intensive study and reaches its greatest abundance in the treeless areas although it is found in both pine forest and chaparral. The runways of this species as in others of the genus *Microtus*, are frequently lined with leaves of plants used as food. Examination of such remains under one log where a live *Microtus mexicanus* was taken showed the following: Seeds and green leaves of *Lupinus montanus* HBK, green leaves of *Senecio scalaris* Greene, seed coverings of seeds from scrub piñon pine (an undescribed species), and seeds and male cones from *Pinus Montezumae*. Remains of

shells of the snail, *Humboldtiana fortis,* with openings cut in them indicated that this species as well as *Peromyscus maniculatus labecula* fed on it. The vole occurred in colonies, especially in the alpine grassland. A yellow composite grew abundantly in these areas indicating a definite relationship between the plant and this small mammal. Clark's Nutcracker, *Nucifraga columbiana* (Wilson), was observed once to fly down during midday and catch a *M. mexicanus.* The bird flew to a tall pine tree where it shook the vole several times, then rested a few moments and flew away with the animal still kicking in its beak. (Koestner and Schneider, 1940).

Mus musculus L. House mouse. "Ratón".

Locality: Ojo de Agua, Municipio de Galeana, N. L.
Habitat: House.

The house mouse was a constant pest to the natives in adobe houses and many specimens were brought in by them. Strangely enough, none were taken in any of the outdoor sets.

Sylvilagus floridanus chapmani (Allen). Texas cottontail. "Conejo".

Locality: Cerro Potosí and Cieneguillas, Municipio de Galeana, N. L.
Habitat: Alpine grassland, scrub piñon pine, chaparral.

This cottontail was taken from the peak of Cerro Potosí as well as lower down occurring in all types of cover of the mountain. Its greatest abundance, as would be expected, was reached in the chaparral.

Odocoileus virginianus miquihuanensis Goldman & Kellogg. Miquihuana white-tailed deer. "Venado".

Locality: Cerro Potosí, Municipio de Galeana, N. L.
Habitat: Pine forest, scrub piñon pine.

A specimen of this newly described subspecies (Goldman & Kellogg 1940) was taken on July 2, and had horns in the velvet. The deer were found to range through the pine forest and scrub pine areas and in early morning and evening would venture out into the alpine meadow to graze, or browse on an occasional scrub near the edge. They occurred at altitudes from 11,000 to 12,500 feet. Although the deer are protected by game laws in Mexico, the natives take them frequently for food. One native showed skins of two unborn fawns that he had taken from a deer killed in June. The deer were abun-

dant on the mountain usually seen in small groups of two to five, although one morning I counted twelve in one herd.

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A STUDY OF THE VARIATION IN THE LESS COMMON SNAKES OF UTAH[1]

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INTRODUCTION

Among the snakes of Utah are a number of species which have been considered as being rare, and were until recent years represented in collections by only a few specimens. Of the 24 species of snakes listed for Utah, 12 species are represented by comparatively few specimens. One species, *Arizona elegans occidentalis,* for example is represented by only two specimens, which were collected in the vicinity of St. George, Utah. Some of the other less common species have, however, been greatly added too during the last few years by careful collecting.

The large numbers of snakes that have been collected by the various institutions and collectors, has made it possible to further study the distribution and morphological variations of certain species.

The materials used in this report came from the following sources: Brigham Young University, labeled B.Y.U.; Zion Canyon National Park, labeled Z.C.N.P. and the University of Utah, labeled U. of U. I am also grateful to Mr. L. M. Klauber for information concerning one specimen of Lyre snake now in the University of California at Los Angeles. I am grateful to Mr. Russell K. Grater for the specimens from Zion Canyon. Many of the notes have come from Dr. Vasco M. Tanner and Dr. D. E. Beck. For these and other courtesies I am grateful.

This study of the scale variation of the less common snakes of Utah is based upon specimens which have been collected within the past fifteen years.

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(1) Contribution No. 89, Department of Zoology and Entomology, Brigham Young University.

DIADOPHIS REGALIS REGALIS (Baird & Girard)

MEASUREMENTS AND SCALE VARIATIONS

	BYU	USAC	ZCNP	ZCNP	U of U	U of U	U of U	U of U	ZCNP
Number	2701		75	69	2006	1213	639	804	23
Sex	F	F	F	F	M	M	M	M	
Scale Row	17–15	17–15	17–15	17–15	17–15	17–15	17–15	17–15	17–15
Gastrosteges	229	226	229	223	208	215	224	223	219
Urosteges	71	64	73	82	72	73	60+	81	79
Supralabials	7–7	7–7	7–7	7–7	7–7	7–7	7–7	7–7	7–7
Infralabials	8–8	7–8	8–8	8–8	8–8	8–8	8–8	8–8	8–8
Preoculars	2–2	2–2	2–2	2–2	2–2	2–2	2–2	2–2	2–2
Postoculars	2–2	2–2	2–2	2–2	2–2	2–2	2–2	2–2	2–2
Loreals	1–1	1–1	1–1	1–1	1–1	1–1	1–1	1–1	1–1
Temporals	1–2	1–1	1–1	1–1	1–1 1–2	1–1 1–2	1–2 1–1	1–2	1–2
Total Length	201	526	726	306	448	360	638	380	510
Tail Length	34	90	124	62	84	86	104	110	107
Ratio	.169	.171	.171	.202	.193	.239	?	.289	.210

PUBLISHED RECORDS: Zion National Park (Tanner 1927 p. 26) (A. M. Woodbury 1931 p. 69) (Presnall 1937 p. 232) (W. W. Tanner 1940 p. 141); Springdale (A. M. Woodbury 1931 p. 69); Pine Valley (Hardy 1939 p. 83); Circleville (W. W. Tanner 1940 p. 141); Deep Creek Mts. (Knowlton & Thomas 1935 p. 264) (W. W. Tanner 1940 p. 141) Utah; and Preston, Idaho (W. W. Tanner 1940 p. 141).

NEW RECORDS: Pole Canyon near Cedar Fort, Ut. Co., U. of U. No. 2006 (H. W. Setzer & D. M. Woodbury, Colls.). Birch Creek Canyon, Juab Co., U. of U. No. 1213 (S. Flowers, Coll.).

REMARKS: At the present writing I am aware of 15 specimens of this species from the Utah area, with a great percentage of them coming from Washington County. From the distribution records now available it becomes quite evident that this snake should be found throughout Utah, wherever a suitable habitat can be found. Records would indicate that this species inhabits the Oak, Juniper, Pinyon-Pine Belts of our foot hills, 5000 ft., and up to the Aspen-Fir Belt at an elevation of 7000 ft. In Southern Utah it has been taken as low as

4045 ft. Because of its secretive habits few specimens are seen or collected. Dr. D. E. Beck collected a specimen from under a pine log at the camp ground in Pine Valley, Washington County. Ross Hardy collecting in the same area found four specimens under rocks in the Oak brush. Mr. M. V. Walker collected a specimen in Oak Creek, Zion National Park during the afternoon. The snake was feeding on a small *Pituophis c. deserticola.* From the information available it appears that this species spends much of its time in secluded places. More collecting may provide an answer to the limits of distribution of this species. Dr. H. J. Pack listed a specimen for St. George, Washington County, Utah.

The general belief that this species is oviparous can now be confirmed. A large specimen from Zion Canyon National Park No. 75 contained 5 eggs, which averaged 19.24 mm. long and 7.2 mm. wide. The two largest eggs were located in the posterior portion of the body and measured in length 24.5 and 26.3 mm. respectively. The smallest measured 13.5 mm. and was the anterior egg. The two middle eggs were intermediate in size measuring 16 mm. each. In none of the eggs was there any indication of a developing embryo. The fact that this specimen was collected in May and contained two apparently fully developed eggs would lead us to believe that some of the eggs are deposited in late spring or early summer.

The size of the above specimen is also noteworthy, it measured 726 mm. long and has a head width of 9.8 mm. and a body circumference at the middle of 36 mm. This I believe is the largest specimen of this species reported for Utah.

Salvadora grahamiae hexalepis (Cope)

Measurements and Scale Variations

	B.Y.U.	B.Y.U.	B.Y.U.	Z.C.N.P.
Number	214	1097	2880	24
Sex	F	F	F	F
Scale Rows	19–17–13	17–17–13	19–17–13	19–17–13
Gastrosteges	198	200	191	198
Urosteges	81	80	66	81
Supralabials	9–9	9–9	9–9	9–9
Infralabials	10–10	10–10	10–10	10–10

Preoculars	3–3	3–3	3–3	2–2
Postoculars	2–3	2–3	2–2	2–2
Loreal	2–2	2–2	2–2	2–2
Temporals	2–3	2–1–3	2–3–3	2–2–3
Total length	693	528	650	737*
Tail length	158	119	broken	169

*This specimen was reported by the writer in the Great Basin Naturalist, Vol. I, No. 3-4, p. 142, 1940, to be 705 mm. long; this was a misprint and is now corrected.

Published Records: St. George (Pack 1930 p. 6) (Tanner 1935 p. 268) Woodbury 1931 p. 82); Cottonwood Canyon (Van Denburgh 1922 p. 691); Four miles Northwest of Santa Clara (Hardy 1939 p. 83); Zion Canyon National Park (W. W. Tanner 1940 p. 142).

Remarks: The scale formulas and measurements are well within the limits set up by C. M. Bogert, in his report, "A Study of the Genus Salvadora." The color pattern suggests that the Utah specimens may vary slightly, or be allied to those specimens of the Grand Canyon area. Four specimens before me all have dark brown bars, extending from the ventrals dorsally. In two specimens the bars invade the dorsal stripe. In one specimen (B.Y.U. No. 214) some of the bars become continuous across the back, others so constrict the dorsal stripe as to leave only one or a fraction of a scale light colored. While this extreme does not carry into all the Utah specimens, they are all distinctly bared.

The habits and habitats of this species are not known to the writer. Specimens have been taken while burrowing in the sand, (Pack 1930); under rocks along the creek (Hardy 1939) and on a lawn which is surrounded by sand and boulders and desert plants, (Zion Canyon, W. W. Tanner 1940). Dr. D. E. Beck collected a specimen northeast of Santa Clara on the rocky hillside. Mr. Bogert indicates that their food consists mostly of lizards, however, other forms such as small mammals, snakes, etc. may form a part of their diet.

Lampropeltis pyromelana (Cope)

Measurements and Scale Variations

	B.Y.U.	B.Y.U.	B.Y.U.	U. of U.	U. of U.
Number	304	322	634	825	940
Sex	M	M	F	F	M

Scale Rows	23–23–19	23–23–19	23–23–17	23–23–17	23–23–19
Gastrosteges	222	222	226	223	225
Urosteges	76	50	75	71	79
Supralabials	7–7	7–7	7–7	7–7	7–7
Infralabials	9–9	9–9	8–8	9–9	9–9
Preoculars	1–1	1–1	1–1	1–1	1–1
Postoculars	2–2	2–2	2–2	2–2	2–2
Loreal	1–1	1–1	1–1	1–2	1–1
Temporals	3–3 2–3	2–3 2–3	2–3 3–4	2–3 2–3	2–3 3–4
Total length	857	905	282	552	805
Tail length	156	121*	47	100	148
White rings body	38	38	44		
White rings tail	12	74	12		

*Tip of tail missing.

Published Records: Granger, Salt Lake Co., Beaver Canyon, Beaver Co., (Van Denburgh 1922 p. 747) (Pack 1930 p. 14) (Woodbury 1931 p. 91); New Harmony, Washington Co., (Tanner 1928 p. 49) (Woodbury 1931 p. 91); and Kolob Mountains (Woodbury 1931 p 91).

New Records: Wallsburg, Wasatch Co., Brigham Young University No. 322; Pine Valley, Washington Co., University of Utah Nos. 825 and 940; and Santa Clara, Washington County, Utah. The specimen listed for Santa Clara was undoubtedly collected at a higher elevation, and brought into Santa Clara. It was later given to Dr. D. E. Beck.

Remarks: With the exception of the Granger record it appears that this species lives in or very near the mountains. It is interesting to note its occurrence in the Wasatch Mountains, as well as the high plateaus from the Pine Valley Mountains north.

The writer is aware of no information on the habits of this snake.

Lampropeltis triangulum gentilis (Baird & Girard)

Measurements and Scale Variations

	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.
Number	2756	398	1505	333	337	336	163	2923	2929	2718	520	334	389
Sex	F	F	F	F	F	F	F	F	F	M	F	M	M
Scale Rows	23-23-19	22-25-19	22-23-19	21-21-19	21-21-17	21-21-17	21-21-17	21-21-19	21-23-19	21-21-19	21-21-18	21-21-17	22-23-19
Gastrosteges	183	183	186	188	183	183	179	182	186	186	185	188	184
Urosteges	46	40	43	42	46	48	40	?	40	47	48	51	47
Supralabials	7–7	7–7	7–7	7–7	7–7	7–7	7–7	7–7	7–7	7–7	7–7	7–7	8–8
Infralabials	8–8	8–8	8–8	8–8	8–8	8–8	8–8	8–8	9–9	8–8	9–9	8–8	9–9
Oculars	1–2	1–1	1–2	1–2	1–2	1–2	1–2	1–2	1–2	1–2	1–2 1–3	1–2	1–2
Temporals	2–3	2–3	2–3	2–3	2–3	2–3	2–2 2–3	2–3	2–3	2–3	2–3	2–2 2–3	2–3
Total length	262	258	205	497	200	202	222	555	533	587	337	534	556
Tail length	39	35	29	70	32	31	31	61?	76	88	49	86	80
Rings body	28	27	30	23	34	29	27	25	29	34	30	23	31
Rings tail	6	8	7	6	10	8	7	4?	7	10	8	8	10

*Loreals 1-1 and anal undivided in all specimens studied.

Published Records: Cedar City Canyon (Van Denburgh 1922 p. 745) (Pack 1930 p. 14); Provo (Van Denburgh 1922 p. 745) (Tanner 1928 p. 27) (Pack 1930 p. 14); Salt Lake, Tooele Valley, Moroni, Bountiful, and Vernal (A. M. Woodbury 1931 p. 93); 8 miles South of Price (Hardy 1939); Alpine, Lehi, and Mt. Pleasant (W. W. Tanner 1940 p. 143).

New Records: Hobble Creek Canyon, 3 miles East of Thistle, Cedar Valley and Spanish Fork, Utah County; Neola, Duchesne County; Pine Valley, Washington County; Fillmore, Millard County; Helper, Carbon County, Utah.

Remarks: A number of *Lampropeltis t. gentilis* captured in Utah County have been observed in the laboratory for several weeks at a time, but as yet feeding has not been observed. Two specimens B.Y.U. No. 2718 collected at Lehi by Harold Hutchings April 30, 1939, and No. 2924, collected in Hobble Creek Canyon by C.C.C. boys, Aug. 1940, contained adult lizards, *Sceloporus g. graciosus.*

The color pattern of this species is quite variable, ranging from a predominance of red to a predominance of black. Specimen B.Y.U. No. 520, collected in Hobble Creek Canyon 1937, has 33 complete red bands ranging from 2-6 scales in width at the dorsal. In this specimen the black bands, anterior to the tail, do not contact each other, either ventrally or dorsally. A second specimen B.Y.U. No. 2756 collected in Alpine, 1939, has only 5 complete red bands and these are only 1-2 scales wide at the dorsal. The black bands are all in contact on the ventral. The white band—and I have seen no Utah specimens with a yellow band as suggested by other writers—averaged 2 scales wide. The head is black with flecks of red or white or both on the frontal, prefrontals and internasals. In some specimens, B.Y.U. No. 2924 for example, the entire head is flecked with red and white. The labials are often white margined with black, and the first white ring usually, but not always, involves the tips of the parietals.

The distribution of this species appears to be state wide, although much collecting must be done to varify this belief.

Several specimens of this snake have been collected during its hibernation and it seems noteworthy to report them at this time. One specimen collected in Cedar Valley Dec. 10, 1940, was taken while digging holes for power line poles. The snake was found in sandy soil 4 feet from the surface. A second specimen was taken from a gravel pit near Helper, Utah, December 15, 1940, by Lester Winters, who gave the specimen to Mr. Horace Richards of Price Junior

College. Mr. Richards deposited the specimen in the Brigham Young University Collection. This specimen was 6 feet under ground. Another specimen was taken from a gravel pit near Mt. Pleasant, Utah.

Rhinocheilus lecontei Baird & Girard

Measurements and Scale Variations

	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	U. of U.	B.Y.U.	Average
Number	1322	2863	213	2931	2036	1162	
Sex	M	M	F	F	F	F	
Scale Rows	23-23-19	23-23-19	23-23-19	23-23-19	23-23-19	23-23-19	
Gastrosteges	202	205	207	199	197	197	201.6
Urosteges	53	53	50	46	43	46	47
Supralabials	8–9	8–8	8–8	8–8	9–9	8–8	
Infralabials	9–9	8–8	9–9	8–8	9–9	8–8	
Preoculars	1–1	1–1	1–1	1–1	1–1	1–1	
Postoculars	2–2	2–2	2–2	2–2	2–2	2–2	
Loreal	1–1	1–1	1–1	1–1	1–1	1–1	
Temporals	2–4 2–3	2–3	1–3	2–3	2–3	2–3	
Total length	161	347	328	234	648	278	
Tail length	94	50	45	32	79	36	
Spots body	30	25	32	32	23	31	27.8
Spots tail	11	10	11	10	11	8	10.2

Published Records: St. George (Van Denburgh 1922 p. 776) (Tanner 1927 p. 57) (Pack 1930 p. 7) (Woodbury 1931 p. 94) (Tanner 1936 p. 269); Veyo (Hardy 1939), Washington County; White Valley, Millard County, (W. W. Tanner 1940 p. 143).

New Record: Fillmore, Millard County, Utah. Summer 1940.

Remarks: Before the distribution of this species can be determined considerable more collecting must be done in western Utah and eastern Nevada. The published records suggest that its distribution extends from southern Utah to southern Idaho.

Almost nothing is known regarding the habits of these snakes. Specimens have been taken in the evening as they were moving from

one desert shrub to another. One specimen at St. George was taken in a cemetery by the sexton while digging a grave.

The numbers of undivided caudal plates varies greatly in the Utah specimens, six specimens range from 14 to 47 undivided plates Two California specimens varied from 14 to 51.

Thamnophis eques (Reuss)

Measurements and Scale Variations

	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.
Number	211	1093	1095	259	1176	1094	212
Sex	F	F	F	F	F	M	M
Scale Rows	19-19-17	19-19-17	19-19-17	19-19-17	19-19-17	19-19-17	19-19-17
Gastrosteges	170	171	167	172	171	174	171
Urosteges	75	75	70	78	74	86	81
Supralabials	8–8	8–8	8–8	7–8	8–8	8–8	8–8
Infralabials	10–10	10–10	10–10	10–10	10–10	10–10	10–10
Preoculars	1–1	1–1	1–1	1–1	1–1	1–1	1–1
Postoculars	3–3	3–3	3–3	3–3	3–3	3–4	3–4
Loreal	1–1	1–1	1–1	1–1	1–1	1–1	1–1
Temporals	1–2 1–3	1–2	1–2	1–2	1–2	1–2	1–2 1–3
Total length	719	504	555	764	525	470	429
Tail length	165	111	123	174	116	113	104

Published Records: Moab, Grand Co., and Bluff, San Juan Co., Utah (Tanner 1928 p. 270) (Woodbury 1931 p. 100).

Remarks: Apparently the only observations on the habitats of these snakes have been made by Dr. A. G. Ruthven and Dr. V. M. Tanner. Both suggest their habitats to be in the immediate vicinity of streams. Dr. Ruthven indicates that their food consists of "frogs and tadpoles which abound in this habitat."

The range of this species in Utah is rather indefinite. It has been taken from only two localities in the Colorado River area of southern Utah.

TRIMORPHODON LYROPHANES (Cope)

MEASUREMENTS AND SCALE VARIATIONS

	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	U.C.L.A.	Average
Number	653	502	501	1798	26	
Sex	F	F	F	M	F	
Scale Rows	21-23-16	20-21-15	22-22-15	23-23-15	23	
Gastrosteges	236	227	229	218	229	
Urosteges	65	78	69	77	63	
Supralabials	8–8	9–9	9–10	9–9	10–9	
Infrailabials	12–13	12–12	12–12	11–12	12–11	
Preoculars	3–3	2–2	3–2	3–3	3–3	
Postoculars	3–3	3–3	3–4	3–3	3–3	
Loreals	2–1	2–2	2–2	2–2	3–3	
Temporals	3–4	3–4	3–5	3–4	3–4	
Total length	657	359	611	296	756	
Tail length	101	59	102	50	116	
Spots on body	31	30	28	32	31	30.14
Spots on tail	12	15	14	16	13	14

PUBLISHED RECORDS: Springdale, (Zion Canyon) (Woodbury 1931 p. 106) Zion Canyon National Park, (Klauber 1940) (W. W. Tanner 1940 p. 145) St. George, Washington County, Utah (V. M. Tanner 1935 p. 269) (W. W. Tanner 1940 p. 145).

REMARKS: Collecting in Utah has produced to date five specimens of the Lyre Snake, all coming from the Lower Sonoran life zone, or areas very closely associated with an connected to it. Just why this species is rarely collected is not known. We surmise that it is on the northern fringe of its range or that its habits are so secretive as to make its capture extremely difficult. Two specimens were collected by Dr. D. E. Beck at the base of the Sugar Loaf hill, St. George, Utah. One specimen had crowded between two flakes of a large rock and the other was found in the soil underneath the same rock. A third specimen collected by Dr. V. M. Tanner was found under a rock on the Sugar Loaf. The fourth specimen was found on the road by Dr. Beck.

The habits of this snake are not well known. They are known, however, to feed on lizards (Woodbury 1931). Dr. Van Denburgh reported a specimen which contained 16 eggs. No information can be added from the specimens which I have studied.

An examination of the four specimens at my disposal, provides the following additional scale variations: The frontal is not in contact with the preoculars in either of the specimens. The scales between the nearest ventral and infralabial, range from 6 to 7 scales. It is interesting to note that the two extremes in the caudals for females exist in Utah specimens, 63 to 78 scales. Equally interesting is the low ventral count of 218 in the single Utah male specimen. The body scales are smooth and imbricate, and the anal is divided in all Utah specimens.

The color pattern while variable, is in the main gray with medium brown blotches.

Tantilla utanensis Blanchard

Measurements and Scale Variations

	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.	B.Y.U.
Number	310	1240	1571	1518	1553	180	2878	2332
Sex	M	F	F	M	M	M	F	F
Scale Rows	15	15	15	15	15	15	15	15
Gastrosteges	154	174	170	157	158	157	167	169
Urosteges	26	62	63	66	68	*	60	60
Supralabials	7–7	7–7	7–7	7–7	7–7	7–7	7–7	7–7
Infralabials	6–6	6–6	6–6	6–6	6–6	6–6	6–6	6–6
Preoculars	1–1	1–1	1–1	1–1	1–1	1–1	1–1	1–1
Postoculars	2–2	2–2	2–2	2–2	2–2	2–2	2–2	2–2
Temporals	1–1	1–1	1–1	1–1	1–1	1–1	1–1	1–1
Total length	214	167	215	270	242		137	141
Tail length	*	37	50	72	61	*	28	27

Published Records: St. George (Van Denburgh 1922 p. 880) (V. M. Tanner 1927 p. 57) (Pack 1930 p. 10) (Woodbury 1931 p. 108) (V. M. Tanner 1935 p. 269) (Blanchard 1938 p. 372); Virgin Mountain (M. Woodbury 1931 p. 108); and Schwitz Indian Reservation, Washington Co., Utah (W. W. Tanner 1940 p. 145).

Remarks: In 1938 a post humous paper by Dr. Frank N. Blanchard was published in which he described the Utah *Tantilla*, and gave to it the name of *Tantilla utahensis*, and St. George, Washington Co., Utah was designated as the type locality. In previous reports the Utah *Tantilla* had been referred to as *T. nigriceps* or *T. nigriceps eiseni*.

During Dr. Blanchard's visit at Brigham Young University in December 1935, many specimens were studied by him, five of which were loaned to him at that time. These five specimens are referred to as the "Beck Collection," and are designated as paratypes. These specimens are still at the University of Michigan.

Specimen No. 310 (2274) is the only paratype specimen in the Brigham Young University Collection although we have 5 specimens, Nos. 1240, 1571, 1553, 1518, and 1800 that are topotypes.

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STUDIES IN THE WEEVILS OF THE WESTERN UNITED STATES NO. IV: A NEW SPECIES OF CIMBOCERA[1]

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Brigham Young University

CIMBOCERA PETERSONI Tanner, new species

FEMALE: Body oblong and robust. Rostrum moderately constricted at base, median and lateral sulci well developed but obscured by imbricate spatulate vari-colored scales which cover all parts of the body and appendages except the clubs of the antennae which are brownish due to a fine vestiture of setae; twice as long as wide at base, distal one and one half times as wide as base. Thorax widest at base; lateral and median vittae of whitish roundish scales. Elytral striae prominent, eleven at middle, intervals smooth and covered with lead-colored scales among which are interspersed whitish ones. The intervals contiguous to the suture are covered with whitish scales which tend to develop a vittae appearance in some specimens. The body and appendages have erect whitish setae which arise from between the scales. On the elytral intervals there is a semblance of two rows of setae to each interval. The length of the body from the prothorax to the apex of the elytra in the type is 8.6 mm; greatest body width 4 mm. Two females before me are only 5 mm. in length. Figure 1.

The female genitalia, as shown in Figure 2, is similar to *pauper*, of this genus, according to illustrations by Ting, (1940).[2] The styli are modified as in *C. pauper*. In *petersoni* the valvifers and coxites are distinct but not so heavily sclerotized as in *pauper*. The genitalia of *C. buchanani* Figure 2c. is similar to *C. petersoni* and *pauper* except for the styli and fused coxite and valvifer. This type of genitalia is used to deposit eggs on leaf or stem surfaces or in open cracks of plants. The spermatheca of *petersoni* is similar to *buchanani*, Figure 2f. The hind tibia of *C. petersoni* is shown in Figure 2g.

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(1) Contribution No. 88, Department of Zoology and Entomology, Brigham Young University.

(2) Ting, P. C., 1940. Revisional Notes Concerned with Cimbocera and Related Genera. Bull. So. Calif. Acad. Sci., Vol. 39, part 2, pp. 128-157, Pls. 24-26. December 15, 1940.

Male. The male of this species may readily be distinguished from the female by the thorax being widest at the middle and the dense long whitish setae of the thorax and elytra. In the three males before me the woolly setae of the elytra has a length of 1.8 mm, which gives the males a marked bearded appearance over that of the females. The third tarsal segment, especially of the first and second legs, is well developed being about twice as long as in the female. The male

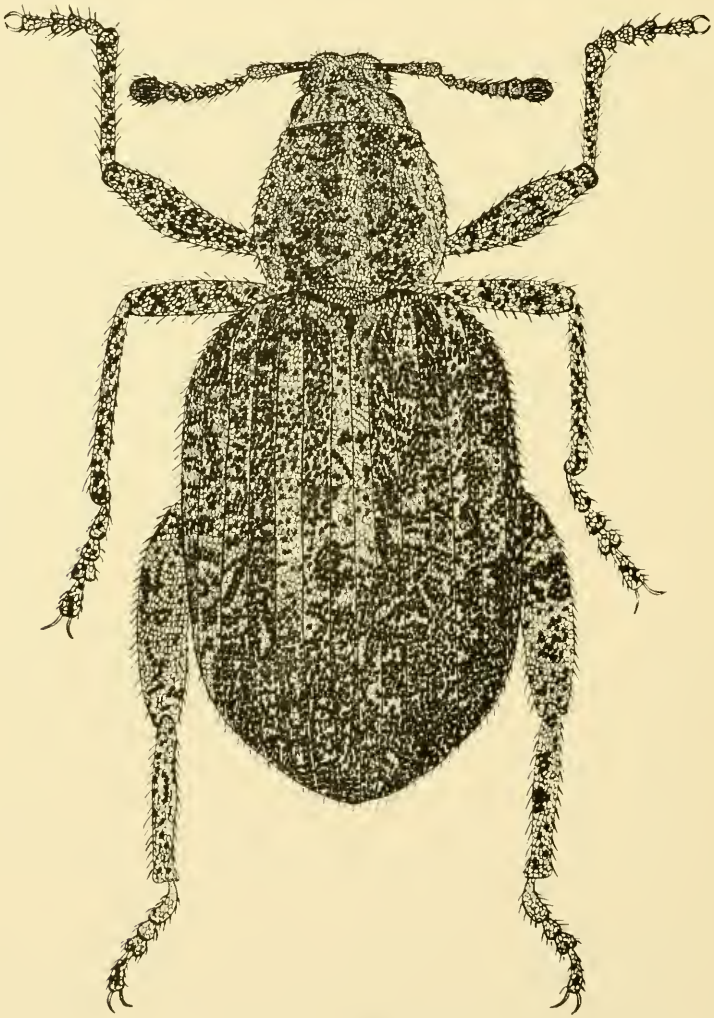

Fig. 1. Drawing of holotype, *Cimbocera petersoni*, new species 10 times.

genitalia, Figure 2d and e, are different to any other species of this and related genera which have been studied. The length of the male from the prothorax to the apex of the elytra is 7.5 mm.

If we follow the key to species of *Cimbocera* as prepared by Mr. Peter Ting (1940), *petersoni* may be separated from other species as follows:

1. Tarsal bristles and tibial spinules pitch black. Pronotum slightly tuberculate.....*buchanani* Ting

   Tarsal bristles and tibial spinules yellow or reddish brown. Pronotum smooth.....2

2. Rostral setae length subequal with head setae. Rostrum with narrow median sulcus; slightly constricted at base and one-third to one-half longer than broad. Color predominantly dark brown.....*pauper* Horn.

   Rostral setae equal in length with the head setae. Rostrum with well developed median and lateral sulci; moderately constricted at base and distal one and one-times as wide as base. Color greyish with some specimens having distinct light and dark vittae on thorax and elytra; setae short in females, long in males.....*petersoni*, new species

   Rostral setae only one-fourth length of head setae. Rostrum without median sulcus; greatly constricted at base and not, or only slightly, longer than broad. Color grey mottled brown or black.....*conspersa* Fall

Type Locality: The Virgin River at St. George, Washington County, Utah. Ten specimens were collected in 1892, by Mr. C. J. Weidt, which are from the Charles W. Leng Collection. The writer collected six specimens in March and April, 1921 and 1922 at St. George, elevation 3,000 feet; one specimen at Washington, Washington County, Utah in April 1921; and one specimen, a female, at Indianola, Sanpete County, Utah, elevation 6,200 feet, in June 1919. I also have before me one specimen collected at St. George by A. M. Woodbury. The type and twelve paratypes, on pins, are in the writer's collection at Brigham Young University. Two paratypes were sent to Mr. L. L. Buchanan of the U. S. National Museum, Washington, D. C. and one paratype was deposited in the Entomological collection of the California Academy of Sciences at San Francisco.

This species is named in memory of Mr. Mervin H. Peterson, an alumnus of Brigham Young University. Mr. Peterson was born at Payson, Utah, on December 4, 1908. He graduated from the Payson

High School in 1927 and the Brigham Young University, with an A. B. degree with a major in Zoology, in 1936. In 1936-37 he was a graduate assistant in Zoology. He died in May, 1937 following a goiter operation. Mr. Peterson was a very capable and promising student of Zoology. At the time of his death, he was working on the phylogeny of the weevils.

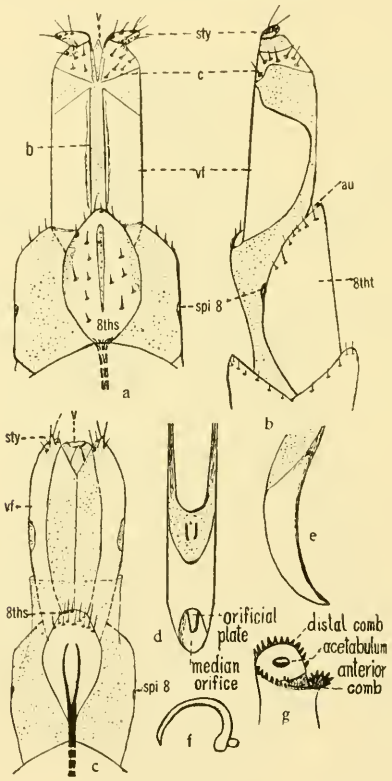

Fig. 2. Genitalia of *Cimbocera petersoni.* a. ventral view of female genitalia; b. lateral view of female genitalia; c. ventral view of female genitalia of *Cimbocera buchanani,* a closely related species; d. and e. dorsal and lateral views of male genitalia of *Cimbocera petersoni*; f. spermatheca of *Cimbocera petersoni*; g. apice of hind tibia of *Cimbocera petersoni.*

WILLIS STANLEY BLATCHLEY (1859-1940)

VASCO M. TANNER[1]

Professor of Zoology and Entomology
Brigham Young University

The passing of Willis Stanley Blatchley must cause Entomologists, especially students of the Coleoptera of the United States, to pause and pay homage to the memory of one of the most distinguished of their ranks.

Willis S. Blatchley was born in North Madison, Connecticut on October 6, 1859, and passed away at his home in Indianapolis, Indiana on May 28, 1940. His parents moved to Indiana in 1860, and this became the home state of our noted Naturalist. Blatchley attended the grade school of Putnam County, and in 1879 began teaching, at which he spent his winter months until 1883 when he entered the University of Indiana as a student of Drs. David Starr Jordon and John C. Branner. He graduated in 1887 with an A. B. degree, writing a thesis on "The Flora of Monroe County, Indiana." In June 1891, he received an A. M. degree, his thesis this time dealt with "The Butterflies of Indiana." Thirty years later, 1921, his Alma Mater conferred upon him the degree of Doctor of Laws (LL.D.).

In 1894 he was elected on the Republican ticket to the office of State Geologist of Indiana, which office he successfully held for sixteen years.

Dr. Blatchley was the author of 246 scientific papers and books. The first of his papers "On the American Species of the Genus Umbra," was published in 1885 in the Proceedings of the Academy of Natural Sciences of Philadelphia, while his last paper, "Blatchleyana II." was published privately in 1939. The following books—*Coleoptera of Indiana,* 1910, pp. 1-1386, figs. 1-595; *Rhynchophora or Weevils of Northeastern America,* 1916, pp. 1-682, figs. 1-155 (Co-author with Chas. Leng); *The Orthoptera of Northeastern America,* 1920, pp. 1-784, pls. I-VII, figs. 1-246; *The Indiana Weed Book,* 1912, pp. 1-192, figs. 1-139; *Heteroptera or True Bugs of Eastern North America,* 1926, pp. 1-1116, pls. I-XII, fig. 1-215; *The Fishes of Indiana,*

(1) Contribution No. 90, Department of Zoology and Entomology, Brigham Young University.

1938, pp. 1-121, fig. 1-39; and *Blatchleyana* I and II, all of which contain more than 4404 pages and 1395 figures will long serve as indispensable handbooks for the areas covered.

Not only was Dr. Blatchley a prolific writer and compiler of information concerning already described species, but he also described 14 new genera of insects, 11 Coleoptera and 3 Heteroptera; 470 species of insects—of which 224 are Coleoptera; 131 Rhynchophora (weevils); 66 Heteroptera and 29 Orthoptera. In 1935 he deposited his entire collection of mounted specimens along with copies of all his books and papers in the cabinets of the Department of Entomology at Purdue University, Lafayette, Indiana. Included in this collection were 470 holotype specimens of new species of insects which he had described.

On July 12, 1928, I visited Dr. Blatchley at his home on 1530 Park Avenue, Indianapolis, Indiana. After seeing his collections, especially the weevils, I obtained from him several specimens including two paratypes of *Blapstinus aciculus* Blatchley. Following this visit, I carried on an interesting correspondence with him. In 1930, I purchased 300 species of weevils from him. These were in capsules and consisted of from 4 to 10 specimens each. Again in 1939, I purchased 83 cuts which were used mainly in his Rhynchophora book. My last letter from Dr. Blatchley, in his own handwriting, came to me from Dunedin, Florida under date of January 4, 1940. Dr. Blatchley had spent his winters in Florida since 1911. I quote the following from this letter:

"Dear Dr. Tanner:

"I came down here, where I have a winter home, on December 3. I had a sorrowful Christmas as my only brother died in a hospital at Greencastle, Indiana on December 22d. He was 67 years of age and had lived on the farm where he was born all his life. He never married but lived with a sister also unmarried. I saw him last on October 6, my 80th birthday, when he and I went fishing together, as we often did in Walnut Creek.

"Did you receive a copy of my "Blatchleyana II-1940—an addenda to my Blatchleyana 1930—sent you some years ago? I ordered one sent to you some time in October.

"Dr. J. C. Bradley, who is getting out a large textbook on the taxonomy of insects, bought all the remaining cuts of my 4 manuals to use as illustrations. The only cuts I have left are those from my 6 nature books, my Indiana weed book and Butterflies and Birds of Indiana. These I would be glad to sell when I return to Indianapolis in May."

Dr. Blatchley was a typical example of what we call the "old time naturalist." For him the stars, the soil and rocks, the wild flowers,

trees, birds, fishes and insects held the secrets of the universe which he tried to fathom. His nature books such as *Woodland Idyls; My Nature Nook; In Days Agone: Boulder Reveries,* and *South America as I Saw It,* contain his philosophy of life, and are also filled with joy and satisfaction gained through a full life. We quote the following from Blatchleyana, 1930, page 16:

> "For fifteen yeasr I have been a naturalist. They have been years full of work, of hopes of ambitions. Happiest those days when I have been alone in woods and fields, when I was learning for the first time lessons from nature—lessons purer, nobler and better than I ever expect to learn from the books of man—lessons showing me the close relationship existing among all animate and inanimate things—teaching me that this world, this universe of ours, is not made up of single, isolated objects and forces, but that each object, each force is but a necessary part of one grand and perfect whole. At the end of fifteen years I am still a tyro—still learning daily new facts from the book of nature, still, and ever expect to be, a tramp naturalist. I still delight to chase the winged butterfly o'er field and pasture; draw the seine through ripple and shallow for silvery minnow and rainbow darter—climb hill and wade through pond for partridge berry or water lily, or wander all day through thicket and forest in search of hermit thrush and hooded warbler. For, as Emerson has said: "In the woods a man casts off his years as the snake his slough and at what period soever of life is always a child. In the woods is perpetual youth."

Dr. Blatchley played an important role in American Entomology and Natural History. His books will long be of value to Zoologists of the United States. The words of Edwin Markham express our feelings at his departure:—

> "As when a lordly cedar green with boughs,
> Goes down with a great shout upon the hills
> And leaves a lonesome place against the sky."

Interesting Coleoptera Records for Utah

The following species of Coleoptera are reported at this time because of their rarity in collections in this region. Wickham and Wolcott (1912), lists ten species of Cleridae not reported at this time. Careful collecting in Utah will add a number of species to the following families.

FAMILY CLERIDAE

Monophylla californica Fall. St. George, Washington Co., April 20, 1924. Three specimens were taken by the writer on *Prosopis glandulosa* Torr.

Cymatodera latefascia Schffr. The Hall, Escalante desert, 50 miles south of Escalante, Garfield Co., June 1936 and St. George, May 1922. V.M.T.

C. ovipennis Lec. Boulder, Garfield Co., July 1936. V.M.T.

C. morosa Lec. Trout Creek, Tooele Co., June and July. Tom Spalding.

C. fuchsi Schffr. "Ten Mile", south of Escalante, Garfield Co., June 1936. V.M.T.

C. brunnea Spin. St. George, Washington Co., June 1922. V. M. T.

Thanasimus undulatus nubilus Klug. Steep Creek, Aquarius Palteau, Garfield Co., June 1936. V.M.T.

Clerus rosmarus Say. Indianola, Sanpete Co., July 7, 1920. V.M.T.

C. spinolae Lec. Glendale, Kane Co., July 1927. D. I. Rasmussen.

C. lactus abruptus Lec. Henrieville, Garfield Co., September 1937. V.M.T.

C. lecontei Wolc. Glendale, Kane Co., May 1932 and Meadow, Millard Co., June. V.M.T.

C. eximius Mann. Wellsville Canyon, Cache Co., June 1926. C. J. D. Brown; Provo Bench, Utah Co. V.M.T.; Provo, Utah Co., April and May. Harry P. Chandler.

Trichodes apivorus Germ. Henrieville, Garfield Co., September 1937. V.M.T. Abundant on rabbit brush, *Chrysothamnus* sp.

T. ornatus Say. This species is widely distributed throughout the state, being common on the blossoms of various flowers. The males and females are variously colored greenish or orange-red with black markings. No specimens of the sub-species *tenellus* Lec., from Utah, are in the collection.

Hydnocera lecontei Wolc. Riverdale, Weber Co., June 1926. V.M.T.; Provo, Utah Co., September. H. P. Chandler.

FAMILY BYRRHIDAE

Cytilus alternatus longulus Csy. Aspen Grove, Mt. Timpanogos, Utah Co., Elev. 6800 feet, August. H. P. Chandler; Utah Lake, Utah Co., May 1927. John E. Blazzard; St. George, Washington Co. Truman Swallow.

Byrrhus laramiensis Csy. Aspen Grove, Mt. Timpanogos, Utah Co., July 1927. V.M.T.

FAMILY EROTYLIDAE

Languria convexicollis Horn. Dividend, Utah Co., May 24. Tom Spalding.

Acropteroxys lecontei Cr. Provo, Utah Co., June 20, 1937. H. P. Chandler.

—V. M. T.

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SOME NEMATODES OF THE FAMILY *TYLENCHIDAE* WHICH DO NOT POSSESS A VALVULAR MEDIAN ESOPHAGEAL BULB

GERALD THORNE
U. S. Bureau of Plant Industry
Salt Lake City, Utah

The collection of nematodes on which this paper is based has accumulated at the Salt Lake City Station of the Division of Nematology during the past 20 years. These specimens have been secured from the great quantity of plant and soil material submitted for examination and identification by various state, government and private agencies and from the extensive faunistic collections made at this station.

As a matter of convenience to the reader, information has been included on related species previously described and certain others of doubtful position. As will be noted, the classification of this group is in a most unsatisfactory state and will remain so until the nemic fauna has been more carefully and extensively studied, for there is no doubt that only a small portion of the existing genera and species are here represented.

Many of the species have been found associated with the roots of alfalfa, cotton, sugar-beets and other cultivated plants but, with the possible exceptions of *Hexatylus viviparus* Goodey, 1926, and *Neotylenchus abulbosus* Steiner, 1931, none is suspected as being of economic importance. Their generally small spears doubtless preclude any possibility of their being able to puncture the cell walls of the higher plants and feed upon their contents unless they invade the cells as true endoparasites. Since they are not known to be endoparasites of either the roots or stems of the higher plants it seems most probable that they feed on the microflora of the soil, such as algae and fungi. Usually they are found in very small numbers which eliminates them as being of any particular importance under the conditions in which they have been observed.

Three distinct types are represented in the species presented which

are here designated as the new subfamilies *Neotylenchinae*, *Paurodontinae*, and *Nothotylenchinae*. These subfamilies are tentatively placed under the family *Tylenchidae* but the *Neotylenchinae* and *Paurodontinae* doubtless will eventually be raised to a family rank because they possess certain characteristics which distinguish them from all other tylenchs.

KEY TO SUBFAMILIES

1. Basal esophageal bulb bearing a stem-like basal extension ..... *Paurodontinae* n.s.f. p. 50
   Basal esophageal bulb not bearing a stem-like basal extension 2
2. Head framework octagonal..... *Neotylenchinae* n.s.f. p. 38
   Head framework hexagonal..... *Nothotylenchinae* n.s.f. p. 56

Neotylenchinae Thorne, new subfamily

Tylenchidae. Body with a characteristic dense texture which obscures anatomical details to a greater degree than is usual in *Tylenchidae*. Corpus of esophagus somewhat cylindroid without a typical tylenchoid median bulb and valvular apparatus. Dorsal esophageal gland frequently greatly developed. Head region octagonal, the framework divided into 8 sectors, some of which may be greatly modified. Arches of cephalic framework generally much lower than in other *Tylenchidae*, forming a low rounded lip region. There are probably ten cephalic papillae although all of them have not been observed on some species. These are arranged on the two lateral and four submedial lips, six minute ones close to the entrance to the vestibule and four near the margins of the submedial lips. Ovary prevulvar, a rudimentary posterior uterine branch rarely present. Spicula and gubernaculum tylenchoid or of very aberrant types *(Hexatylus fungorum* and *Iotonchium imperfectum)*.

Diagnosis: *Tylenchidae* without a valvular median esophageal bulb. Differentiated from *Nothotylenchinae* by the more dense texture of the body, the octagonal lip region which is divided into 8 sectors, the rare occurrence of a posterior uterine branch and, frequently, the increased size of the dorsal esophageal gland. From *Paurodontinae* it is immediately distinguished by the absence of the stem-like extension of the basal esophageal bulb so typical of this subfamily.

Type Genus: *Neotylenchus* Steiner, 1931.

The subfamily *Neotylenchinae* now includes four genera possessing certain general characteristics which indicate that they have a common, though distinct, relationship. However the anatomical fea-

tures of the esophagi and reproductive systems are very different in these genera, which may indicate they they belong to an exceedingly ancient group of organisms. Considering the apparent rarity of most of the species included in this subfamily it would appear that the group is now in its senility.

KEY TO GENERA OF *NEOTYLENCHINAE*

1. Lip region broadly expanded, spicula angular, gubernaculum absent.....*Iotonchium* Cobb p. 50
   Lip region not broadly expanded, spicula, where known, not angular, gubernaculum present..... 2
2. Esophagus base fused with intestine, not set off in any manner .....*Hexatylus* Goodey p. 48
   Esophagus base set off, bulb-like or with greatly developed glands 3
3. Intestine joining esophagus just back of nerve ring, glands lying free in the body cavity..*Deladenus* n.g. p. 45
   Intestine not joining esophagus near nerve ring, glands within a basal bulb.....*Neotylenchus* Steiner p. 39

GENUS *NEOTYLENCHUS* STEINER, 1931

Basal bulb of esophagus definitely set off from intestine, the dorsal esophageal gland sometimes enlarged until it forms a lobe extending a short distance back over the intenstine. Lumen of esophagus continuous, not interrupted by a muscular valvular apparatus near the base of the corpus. Spear generally with three definite basal knobs. Ovary prevulvar, outstretched or reflexed. Post-uterine branch absent, except in *Neotylenchus latus*. Spicula, gubernaculum and bursa tylenchoid.

Diagnosis: *Neotylenchinae* possessing a definitely set off basal esophageal bulb and a continuous lumen. Bursa, spicula, and gubernaculum tylenchoid.

Type Species: *Neotylenchus abulbosus* Steiner, 1931.

Comparison of several species of *Neotylenchus* with *Hexatylus viviparus* has demonstrated that these two genera are both valid, being distinguished from each other by the structure of the esophagus, that of *Neotylenchus* possessing a definitely set off basal bulb and a continuous lumen while that of *Hexatylus* is completely fused with the intestine and has a direct break in the lumen near the base of the corpus.

However extreme care must be exercised in identifying these

genera as evidenced by the fact that Dr. Steiner sent the writer specimens of *Hexatylus viviparus* from Germany, which, on casual observation, were thought to be *Neotylenchus abulbosus*. This led to the writer incorrectly to identify *H. viviparus* as *N. abulbosus* in sugar-beets (23).

KEY TO SPECIES OF *NEOTYLENCHUS*

1. Vulva almost terminal.....*obesus* Thorne p. 44
   Vulva well in front of terminus..... 2
2. Posterior uterine branch present.....*latus* Thorne p. 43
   Posterior uterine branch absent..... 3
3. Female tails elongate conoid, a = 8–10..... 4
   Female tails not elongate conoid, a = 15–20..... 5
4. Oöcytes arranged tandem in ovary.....*acutus* n. sp. p. 42
   Oöcytes massed in ovary.....*coprophagus* (Goodey) p. 42
5. Terminus acute 6
   Terminus blunt, rounded..... 7
6. Lip region set off by constriction, male with normal spicula and spear.....*consobrinus* (deMan) p. 41
   Lip region not set off, male with degenerate spicula and without spear.....*abulbosus* Steiner p. 40
7. Bursa enveloping tail, ♀ tail sub cylindroid, very blunt .....*intermedius* (Christie) p. 45
   Bursa not enveloping tail, ♀ tail conoid to small, blunt terminus .....*arcuatus* n. sp. p. 44

NEOTYLENCHUS ABULBOSUS Steiner, 1931

SYNONYM: *Hexatylus abulbosus* (Steiner, 1931) Goodey, 1933

Plate 1, Fig. 1, 1a

♀: 0.76 mm; a = 27; b = 5.5; c = 10.5; V = 67 86.
♂: 0.74 mm; a = 39; b = 11.2; c = 20.

The cylindroid neck, tapering rapidly in its anterior fourth, and the low rounded lip region are well illustrated in Steiner's figure (Plate 1, fig. 1) as is also the form of the esophagus which constitutes one of the most important characters of this genus. Posteriorly the body is shaped much like that of *Hexatylus viviparus* (Plate 4, fig. 9d), the distance from the vulva to the anus being somewhat shorter than the tail length, cuticle marked by four wings. *En face* the head is observed to be divided into eight sectors of practically

equal size. Spear very short, bearing outward curved processes on the distinct basal knobs. Ovary outstretched, sometimes reaching as far as the excretory pore. Male without a spear. Spicula and gubernaculum poorly developed. Bursa crenate, rising slightly in front of the spicula and extending to the terminus.

Neotylenchus abulbosus appears to be most closely related to *N. consobrinus* from which it differs in the rounded lip region, shorter female spear with the outward pointing curved processes of the basal knobs, the absence of a spear in the male and the poorly developed spicula and gubernaculum.

Steiner found this species inhabiting the buds, stems and leaves of strawberry plants affected by "yellows" or "xanthosis" from California and there appears to be little doubt that it is actually endoparasitic, although symptoms have not been accurately defined.

References: 3, 12, 13, 19, 20, 23.

Neotylenchus consobrinus (deMan, 1906) Filipjev, 1936

Synonyms: *Tylenchus consobrinus* deMan, 1906
Hexatylus consobrinus (deMan, 1906) Goodey, 1932

Plate 1, Fig. 2

♀: 0.96 — 1.24 mm; a = 27–36; b = 5.7–7.3; c = 19–23; V — 89–90.
♂: 0.83 — 0.98 mm; a = 36–45; b = 6.3–7.7; c = 17.5–23.

The cap-like lip region is set off by a distinct, though slight, constriction. Two parts of the spear are about equal in length, the shaft bearing very small basal knobs. Esophagus in all respects very similar to that of *Neotylenchus abulbosus*, definitely set off from the intestine. Ovary reflexed a short distance, the oöcytes arranged in single file. Posterior uterine branch absent. Vulva to anus distance slightly greater than length of tail. Spicula and gubernaculum normally developed, tylenchoid. Bursa rising a little anterior to the spicula and enveloping the tail. The above measurements and description from Goodey (14).

Habitat: Sandy soil, Holland, Austria and South Wales.

Transfer of this species to *Neotylenchus* has been made on the basis of its very close resemblance to *N. abulbosus*.

Neotylenchus consobrinus is readily distinguished from *N. abulbosus*, its nearest relative, by the set-off lip region, longer spear with small knobs and the normal, tylenchoid spicula and gubernaculum.

References: 6, 11, 12, 14, 16.

NEOTYLENCHUS ACUTUS Thorne, new species

Plate I, Fig. 3-3c

♀: 0.8 mm; a = 26; b = 4.4; c = 9; V — 60 83.

Body tapering rather uniformly to the rounded lip region which is not set off in any manner, while posteriorly ending in a conoid acute terminus. Transverse striae obscure, more distinct on subcuticle. Wing area a smooth, refractive band about one-fourth as wide as the body. *En face* the head region is found to have the usual eight sectors, the lateral ones much reduced, similar to those of *Neotylenchus latus* (fig. 4). Anterior portion of spear conspicuously set off, about one-half as long as the shaft which bears small but distinct basal knobs. Corpus of esophagus rather cylindrical narrowing to the slender isthmus which passes through the prominent nerve ring. Basal portion of esophagus made up largely of the huge dorsal gland which extends back over the anterior end of the intestine, crowding it to one side, (fig. 3a). Intestine with narrow lumen and dense, thick walls. Vulva a broad, depressed slit. Vagina well sclerotized. Ovary with oöcytes arranged in single file and forming a double flexure (fig. 3c), an unusual thing in this group of nemas. Male unknown and the single female observed contained no spermatozoa.

DIAGNOSIS: *Neotylenchus* most closely related to *N. coprophagus* Goodey, from which it differs in its longer neck, more cylindrical corpus of esophagus, longer isthmus, more posterior position of the excretory pore and the tandem arrangement of oöcytes in the ovary.

HABITAT: Frass of a bark beetle, *Ips lecontei* Swaine, from pinyon pine, *Pinus edulis* Engelmn. near Tabiona, Utah, collected by L. J. Farmer, U. S. Forest Service.

NEOTYLENCHUS COPROPHAGUS (Goodey, 1938) new combination

Plate IX, Fig. 25

♀: 0.88–1.45 mm; a = 18.5–27; b = 6.3–7; c = 8–10.4; V — 82–86.

Body tapering anteriorly until the lip region is only about one-fourth as wide as the neck base, while posteriorly ending in an elongate-conoid pointed tail. Spear 11 – 12 μ long with small but definite knobs. Anterior conical part of spear only half as long as shaft. Esophagus with spindle-shaped corpus two-thirds as wide as neck, narrow short isthmus and lobed basal bulb. Excretory pore opposite

base of lobed bulb. Ovary outstretched, several oöcytes in diameter, probably arranged about a rachis.

This species is closely related to *Neotylenchus acutus*, but differs in shorter, more robust corpus of the esophagus, the more posterior position of the excretory pore and the multiple rows of oocytes which probably are arranged about a rachis.

Transfer of this species to *Neotylenchus* is based on the fact that it obviously is closely related to *N. acutus*, which is without doubt a *Neotylenchus*. Unfortunately the figure for this species was overlooked until the last plate was being assembled, hence its allocation to Plate IX.

HABITAT: Sheep droppings, Winches Farm, St. Albans, England.
REFERENCE: 14.

NEOTYLENCHUS LATUS Thorne, 1935

Plate I, Fig. 4, 4a

♀: 0.7–1.1 mm; a = 17; b = 6.3; c = 18; V = $^{55}85-^{6}$.
♂: 0.8 mm; a = 31; b = 4.7; c = 20; T = 65.

Female attaining its greatest width at about 65 percent. Neck tapering uniformly to the lip region which is not set off in any manner. Wing area marked by four refractive lines. Lateral sectors of head greatly reduced, the amphid apertures distinctly elevated. Spear about 7 μ long with well developed knobs. Esophagus with broadly cylindrical corpus, narrow isthmus and well developed, distinctly set off, basal bulb. Dorsal esophageal gland frequently developed until it rises from the contour of the basal bulb but not usually so conspicuously so as in the specimen figured in the original description.

Oöcytes in several series, perhaps arranged about a narrow rachis. Posterior uterine branch present. Spicula, gubernaculum and bursa tylenchoid, the bursa extending almost to the end of the small but blunt terminus.

Neotylenchus latus is immediately distinguished by the presence of a posterior uterine branch.

HABITAT: Small lesions on roots of shadscale, *Atriplex confertifolia* (Torr. and Frem.) S. Wats., and in the soil surrounding them collected in the desert west of Utah Lake and Richfield, Utah. Also from soil in wheat field near Taylorsville, Utah.

REFERENCE: 22.

Neotylenchus obesus Thorne, 1934

Plate 1, Fig. 5, 5a

♀: 0.7–0.9 mm; a = 10–16; b = 5–6; c = 20–50; V — 95-99.

The obese body varies greatly in form and width. Spear length, 7 μ, with very small knobs. Head rounded with delicate framework in eight almost equal sectors. Esophagus with somewhat spindle-shaped corpus, narrow isthmus and definitely set off basal bulb but the latter generally is obscured by the ovary. Ovary outstretched to opposite nerve ring or even further, with many oöcytes in a circumference, apparently arranged about a rachis. Vulva transverse, sometimes almost terminal. Male unknown.

No other known *Neotylenchus* has such an obese, almost sausage-shaped body and posteriorly located vulva.

Habitat: Eight females from small pit-like lesions on alfalfa crowns, Greely, Colorado.

Reference: 21.

Neotylenchus arcuatus Thorne, new species

Plate 2, Fig. 6–6d

♀: 1.1 mm; a = 15; b = 9; c = 22.5; V — 72 88.
♂: 1.1 mm; a= 39; b = 6.3; c = 17; T — 53.

The obese body of the female usually is found coiled into an open "C". The wing area bears six refractive lines which, on the male occupy about one-fifth of the body width. Lip region divided into the usual eight sectors, the lateral ones which bear the amphids being much reduced. Spear unusually slender, almost devoid of basal knobs. Corpus of esophagus with a slight basal swelling; basal bulb with enlarged glands extending back over its junction with the intestine. Intestine with dense, thick cells in which the nuclei are plainly visible. Ovary sometimes outstretched but generally reflexed a short distance. Posterior uterine branch absent. Eggs slightly longer than body width and half as wide as long. Vulva a broad, transverse slit with elevated labia. Male tail usually bent somewhat dorsad. Testis outstretched. Spicula and gubernaculum tylenchoid. Bursa crenate, extending from a point about opposite the proximal ends of the spicula to near the terminus of the tail.

Diagnosis: *Neotylenchus* with six lines in the wing area, spear

only slightly knobbed, short blunt female tail and a longer, more pointed male tail.

HABITAT: Soil about roots of *Larrea tridentata* (D. C.) Vail., collected near Littlefield, Arizona, by E. W. Davis, U. S. Bureau of Entomology and Plant Quarantine.

NEOTYLENCHUS INTERMEDIUS (Christie, 1938) new combination

SYNONYM: *Hexatylus intermedius* Christie, 1938.

Plate III

♀: 1.46 mm; a = 36; b = 7; c = 21; V — 88-94.
♂: 1.21 mm; a = 35; b = 8; c = 21.

Head rounded, not distinctly set off, dorsal and ventral sectors much reduced. Six minute papillae closely grouped about the oral entrance. Spear 4 to 4.5 μ long with distinct, somewhat diverging basal knobs. Ovary with S-shaped flexure. Other characters as illustrated in Christie's illustration, Plate III.

Neotylenchus intermedius is immediately distinguished by the very small spear and the subcylindroid, blunt female tail.

HABITAT: Decaying citrus fruit, Riverside, California.

Regarding its habits, Dr. Christie states: "*Neotylenchus intermedius* was kept on cultures for about three months. At two-week intervals it was transferred to new cultures on which the fungus *Alternaria citri* previously had been established. It laid eggs freely, built up a moderately large population and appeared to thrive fairly well."

The writer is indebted to Dr. Christie for the loan of his excellent plate.

REFERENCE: 3.

GENUS *DELADENUS* THORNE, NEW GENUS

NEOTYLENCHINAE. Esophagus joining intestine immediately behind nerve ring, the esophageal glands lying free in the body. A chamber-like valvular apparatus sometimes present in the base of the corpus of the esophagus. Vulva located less than 10% from terminus. Ovary prevulvar. Posterior uterine branch absent. Spicula and gubernaculum tylenchoid. Bursa practically enveloping tail.

DIAGNOSIS: *Neotylenchinae* with the above general characters. Especially distinctive because the intestine joins the esophagus immediately behind the nerve ring.

TYPE SPECIES: *Deladenus durus* (Cobb) new combination.

DELADENUS DURUS (Cobb, 1922) new combination

SYNONYM: *Tylenchus durus* Cobb, 1922.

Plate 11, Figs. 7–7i

♀: 1.0 mm; a = 30–50; b = 8–10; c = 25; V = 70 93.
♂: 1.0 mm; a = 50; b = 8.0; c = 24.0; T = 65.

Body rather uniformly cylindrical except at the extremities where it tapers distinctly (figs. 7, 7f). Cuticle marked by transverse striae about 1.5 μ apart. Wing area elevated, consisting of six longitudinal elements. Deirids located in about the latitude of the excretory pore. Phasmids not seen. A single papillae was observed on each of the four rounded lips. Amphid apertures located close to entrance of vestibule. *En face* the head framework is seen to be divided into eight sectors the lateral ones being much reduced. Spear about 8 μ long with well developed basal knobs. Corpus of esophagus with a fusiform basal swelling which contains an ovoid valvular apparatus, which probably is similar in action to that of *Hexatylus viviparus*. The narrow isthmus passes through the conspicuous nerve ring immediately to join the anterior end of the intestine. Joining the dorsal side of the isthmus is the unusually large dorsal esophageal gland which is from four to six times as long as the corresponding body diameter and contains a conspicuous nucleus. The ventrosubmedian glands and their nuclei were not observed. Excretory pore with heavily sclerotized tube which soon is lost to sight in the body tissues but which probably leads to a conspicuous gland nucleus about 10 body widths posterior to the pore. Intestinal lumen very narrow, beginning to zig-zag almost immediately behind the esophagus and finally becoming twisted and convoluted in a most amazing manner (fig. 7g). Cells of intestine small, the nuclei lying between the bends of the lumen. In some specimens the lumen was broad at is junction with the rectum (fig. 7h) in others it remained narrow (fig. 7f).

Vulva a broad, transverse slit from which the heavily sclerotized vagina leads in and forward to the muscular uterus. Many ova may be present at one time. At first the oöcytes are arranged in single file but, as growth takes place, the ovary is distended and the oöcytes lie in four rows. No rachis was observed. Male tail bearing a bursa which rises a little in front of the spicula and envelopes all but the extreme tip of the tail. Spicula tylenchoid, resting on a simple, curved, trough-like gubernaculum. Testis outstretched.

DIAGNOSIS: *Deladenus* with an avoid valvular apparatus in the

corpus of the esophagus and greatly developed dorsal esophageal gland. Amphids lying deep in the lateral labial axils. Lumen of intestine greatly convoluted. Wing area elevated and divided into six elements.

HABITAT: Described by Cobb from galls of chestnut oak, *Quercus prinus* L., near Lebanon Church Postoffice, Virginia. Decaying fungus, *Pleurota* sp., and under dead bark of cottonwood, *Populus fremonti*, S. Wats., on which the fungus was growing. Collected by C. W. McBeth near Payson, Utah. Also from soil about alfalfa crowns near Manti and Murray, Utah, and Medford, Oregon. The only two males found were in the Manti collection. The specimens from soil generally had slightly longer necks and the excretory pore was somewhat more posteriad.

REFERENCE: 4a.

DELADENUS OBESUS Thorne, new species

Plate IV, Figs. 8 – 8c

♀: 1.0–1.5 mm; a = 16–22; b = ?; c = 30; V – 85 93.

Distinct striae near the lip region are about 1.5 μ wide but these become obscure on the neck and body, sometimes being visible only on the subcuticle. Phasmids and derids not observed. A definite wing area is not visible but in cross section there is a sclerotized band about one-fourth as wide as the body which is not set off in any manner and this may be marked by eight or ten excessively minute striae. Excretory pore, duct and gland not seen. *En face* the head is seen to be divided into 8 sectors the lateral ones which bear the amphids being much reduced. Vestibule a refractive tube. Corpus of esophagus elongate, spindle shaped. Lumen of esophagus unbroken, joining with the broad lumen of the intestine close behind the nerve ring. Esophageal glands grouped about the anterior end of the intestine in flattened lobes. Lumen of intestine at first broad, then narrowed and convoluted, but not so extremely bent as in *Deladenus durus*. A short, postrectal sac was present in one of the two specimens examined. Vulva a broad transverse slit with prominent labia. Vagina extending in and then forward to the conspicuously cellular oviduct. Eggs about half as wide as body and four to six times as long as wide. Great numbers of oöcytes are arranged in eight or ten lines about a prominent rachis. In old females the ovary may be outstretched past the nerve ring or reflexed a short distance, the terminus lying dorsad in the body while the major portion of the ovary is ventrad. Male unknown.

Diagnosis: *Deladenus*-like form without an ovoid valvular apparatus in the corpus of the esophagus. Esophageal glands lobe-like, grouped about the anterior end of the intestine.. Wing area an obscure band.

Placing this species in *Deladenus* is a questionable procedure because it lacks the characteristic ovoid valvular apparatus in the corpus of the esophagus.

Habitat: Frass of unidentified beetles under bark of dead white fir, *Abies concolor* Lindl., near Wolf Creek Summit, South Fork of Provo River, Utah.

GENUS *HEXATYLUS* GOODEY, 1926

Diagnosis Emended: *Neotylenchinae*. Esophagus base fused with intestine. Lumen of esophagus with a distinct break near the base of the corpus where the lumen becomes much wider, the walls heavier and a muscular valvular apparatus apparently is present. Pharynx slightly sclerotized, forming several minute guiding rings for the spear. Spear with three well-developed basal knobs, each of which is somewhat duplex. The outer surface of these basal knobs is unusually refractive and conspicuous. *En face* the octagonal lip region is observed to be divided into 12 approximately equal sectors with four smaller triangular sectors at the submedial angles through which the circlet of four papillae emerge. (Plate IV, Fig 9). The basal framework of the head retains the octagonal pattern of the genus (Fig. 9a), although in some specimens there is a tendency for the 16-sector pattern seen at the surface to continue back to the basal framework.

Type Species: *Hexatylus viviparus* Goodey, 1926.

The above emended diagnosis is based on specimens kindly sent to the writer by Dr. Goodey from Middlesex, England. Dr. Steiner also forwarded specimens from potatoes imported from Germany which proved to be identical to those from England. Specimens collected by the writer from Utah and California were also compared, lateral and *en face* examinations being made of specimens from all four collections.

KEY TO SPECIES OF *HEXATYLUS*

1. ♀ length near 3.0 mm, tail ventrally arcuate.....
.....*fungorum* (Bütschli) p. 49

♀ length 1.5 mm or less, tail straight..*viviparus* Goodey p. 49

Hexatylus viviparus Goodey, 1926

Plate IV, Figs. 9–9d

♀: 1.0–1.5 mm; a = 15–35; b = 5–7; c = 17–20; V = ^{70}89.

With characters of the genus. The great variation in width is found between females which have reached their normal length but have not begun egg production, and those approaching senility. Senile specimens frequently somewhat shorter than the younger forms associated with them. Phasmids and deirids not observed. Wing area marked by four refractive lines, the two outer ones being more prominent. The tissues of the basal portion of the esophagus are somewhat less dense in texture than those of the intestine to which they are fused. This basal portion encloses a number of nuclei, some of which appear identical to those of the intestine while others are probably the nuclei of the esophageal glands. Nuclei of intestinal cells less than one body width apart. Intestine probably four cells to a circumference but this point was not definitely determined as cell walls were not visible.

Ovary of adults reaching as far forward as the nerve ring, the anterior portion made up of several hundred massed oöcytes which, as they increase in size, are observed to be grouped about a prominent rachis. Only the anterior half of the ovary is occupied by the oöcytes, the remainder being a long tube in which the ova develop. A short oviduct leads to a pouch-like uterus. Vulva a broad transverse slit.

Habitat: Described by Goodey from a diseased potato tuber and also decaying gladiolus corms. Cultures from the corm transferred to 2% malt-extract agar gave a good growth of fungus mycelium on which these nematodes thrived and reproduced in great numbers. Goodey therefore regards the species as saprophagous rather than an obligate parasite.

References: 3, 6, 9, 10, 12, 13, 19, 20.

Hexatylus fungorum (Bütschli, 1873) Goodey, 1932

Synonyms: *Tylenchus fungorum* Bütschli, 1873.
Neotylenchus fungorum (Bütschli, 1873) Filipjex, 1936.

Plate IV, Fig. 10, 10a

♀: 3.0 mm; a = 21; b = ?; c = 30; V = 93.8.
♂: 1.6–2.0 mm; a = ?; b = ?; c = 15.

Spear very small, 0.0129 mm in full-grown female. Esophagus indefinite but Bütschli shows a cylindrical corpus narrowing to a slender isthmus which apparently joins directly to the intestine as it does in *Hexatylus viviparus*. Ovary outstretched, very broad anteriorly as if the oöcytes were arranged about a rachis. Several of the small ova are arranged in single file in the long oviduct. Vulva a depressed slit. Spicula and gubernaculum of a most extraordinary form. Bursa three times as long as the tail, completely enveloping the terminus.

Habitat: *Decaying fungus*, Germany.

Goodey's designation of this species to *Hexatylus* perhaps brings it into the correct subfamily but the writer feels that it probably belongs to an unknown genus. However, this question will not be solved until specimens are again collected.

References: 1, 3, 6, 11.

Iotonchium imperfectum (Bütschli, 1876) Cobb, 1920

Synonym: *Tylenchus imperfectus* Bütschli, 1876

Plate IV, Figs. 11 – 11b

♀: 1.8 mm; a = 24; b = 7.2; c = 12.9; V = 88.

Head truncated, set off by expansion. Spear of female 8 μ long while in the male it is reduced to a mere point. Intestine clear and transparent. Gonads reaching to near base of esophagus. Eggs slightly longer than body width. Males smaller than females. Spicula yellow or brown in color, very angular. Gubernaculum absent. Bursa rising one body width anterior to spicula and completely encompassing the tail.

Bütschli states that in general structure this species resembles *Hexatylus fungorum* (Bütschli, 1873) so we are probably safe in assuming that it has a *Hexatylus*-like esophagus.

Habitat: Decaying mushrooms, Germany.

References: 2, 4, 6.

Paurodontinae Thorne, new subfamily

Tylenchidae. Basal esophageal bulb possessing a stem-like extension. Intestine often enveloping part, or even all, of the basal esophageal bulb. Ovary prevulvar, outstretched. Posterior uterine branch absent. Spicula tylenchoid. Bursa enveloping tail. Body generally very dense in texture and details frequently difficult to observe.

Diagnosis: The subfamily *Paurodontinae* is immediately differentiated from all other *Tylenchidae* by the stem-like extension of the esophageal bulb.

Type Genus: *Paurodontus* Thorne, new genus.

KEY TO GENERA OF *PAURODONTINAE*

Spear knobs symmetrical.....*Paurodontus* n. g. p. 51
Spear knobs asymmetrical, the ventrosubmedian much larger than the dorsal.....*Stictylus* n. g. p. 54

GENUS *PAURODONTUS* THORNE, NEW GENUS

Paurodontinae. Characters of the subfamily. Knobs of spear symmetrical, or nearly so. Tails of both sexes acute or subacute. Bursa, where known, not enveloping entire tail.

Diagnosis: *Paurodontus* is immediately distinguished from *Stictylus*, its only known relative, by the symmetrical basal knobs of the spear and the pointed tails of both sexes.

Type Species: *Paurodontus gracilis*, n. sp.

KEY TO SPECIES OF *PAURODONTUS*

1. Length about 0.7 mm.....*gracilis* n. sp. p. 51
Length about 0.4 mm..... 2
2. Terminus subacute, tail somewhat arcuate..*densus* n. sp. p. 52
Terminus acute, tail rather straight..... 3
3. Head about half as wide as neck base....*apiticus* n. sp. p. 53
Head almost as wide as neck base.....*niger* n. sp. p. 54

Paurodontus gracilis Thorne, new species

Plate V, Figs. 12–12d

♀: 0.74 mm; a = 31; b = 7.2; c = 7.2; V = $^{54}76^{3}$.
♂: 0.65 mm; a = 35; b = 5.5; c = 6.5; T = 58.

Cuticle marked by transverse striae, which are about 1.3 μ apart at their widest points. Wing areas marked by four equally spaced, refractive lines occupying about one-third the body width. Deirids and phasmids not seen. Lip region low, rounded. Amphidial apertures located on minute elevations of the lateral lips. Spear slightly longer than width of head with distinct basal knobs. Corpus of esophagus cylindrical, narrowing to the slender isthmus which passes through the conspicuous nerve ring and then enlarges to form the

basal bulb. This bulb bears an elongated tubular valvular apparatus by which it is connected with the intestine. A peculiar chamber, which apparently is formed by the extended walls of the intestine, surrounds the bulb. Nucleus of the dorsal esophageal gland easily seen but the two submedian gland nuclei are very obscure. Intestine made up of large thick cells, each with a distinct nucleus.

Anterior ovary outstretched, the ova arranged in single file. Anterior portion of oviduct forming a spermatheca. Vulva a transverse slit. Posterior uterine branch rudimentary, about as long as width of body. Spicula tylenchoid, arcuate. Gubernaculum thin, curver, trough-like. Bursa slightly crenate, two and one-half times as long as anal body diameter. Testis outstretched.

Diagnosis: *Paurodontus* with the above measurements and general description. Distinctive because of the slender, acutely, pointed tail, four wings and a rudimentary posterior uterine branch.

Habitat: Soil about cotton roots, collected by C. W. McBeth, Tifton, Georgia.

Paurodontus densus Thorne, new species

Plate V, Figs. 13–13c

♀: 0.4 mm; a = 25; b = 5.7; c = 12; V — 55 82.

Anteriorly the body tapers gradually so that the width of the head is about one-half that of the base of the neck. Posteriorly there is a rapid tapering from the vulva to the subacute terminus of the slightly arcuate tail. Wing area one-third as wide as body and appearing as six bright lines, the two outer ones more conspicuous. On the neck and tail there is a reduction in numbers of the wing lines until they practically disappear at the extremities. Phasmids not seen but a very indistinct deirid was observed on one specimen, located in the middle of the wing area about opposite the esophageal bulb. *En face* the head is found to be composed of six sectors, the two lateral ones which bear the amphids being much narrower than the four submedian on which the papillae are located. Vestibule a sclerotized tube. Spear strongly knobbed but the knobs and the shaft are generally very difficult to see on glycerin-mounted specimens because of their refractive index. Esophagus beginning as a rather uniform tube about one-third as wide as the neck, narrowing through the nerve ring and then expanding to form the spindle-shaped bulb with its long posterior extension (fig. 13a). Esophageal gland nuclei within the bulb, apparently three in number but nothing was determined concerning their outlets.

Excretory tube strongly sclerotized. Intestine almost filling the body cavity, without distinct cell arrangement. A peculiar structure surrounds the extension of the esophageal bulb, resembling the tissues of the intestine.

Vulva a broad, depressed slit. Vagina extending inward to join the thin-walled uterus. Oviduct elongated, cellular, but apparently not bearing a special branch like that of *Paurodontus apiticus*. Ovary composed of very small oöcytes arranged in single file. In the distal end of the oviduct of some specimens there were numbers of bodies which appeared to be spermatozoa but no males were collected.

Diagnosis: *Paurodontus* with the above measurements and general characters. Most closely related to *P. niger* from which it differs in the stronger spear, slightly arcuate tail with subacute terminus and the proportionately greater distance between the vulva and anus.

Habitat: Soil about the roots of date palms, McMillian gardens, Indio, California.

Paurodontus apiticus Thorne, new species

Plate V, Fig. 14–14d

♀: 0.42–0.7 mm; a—16-22; b—4.0-7.0; c—8.2-12.0; V—^{45} 80-^{56} 85.

As the above formulae show there is a great diversity in size and body proportions in this species. The obese body tapers anteriorly until the lip region is only about two-fifths as wide as the base of the neck while posteriorly it diminishes rapidly from the vulva to the spicate terminus. Usually the body becomes almost straight when the nema is killed by gradual heat. Transverse striae are easily visible throughout the length of the body. Wings very obscure except on the neck. Phasmids and deirids not seen. Head, *en face*, in 6 sectors, the four submedian ones bearing papillae and the two narrow, protruding, lateral ones bearing the amphids. Vestibule a sclerotized, conoid tapering tube. Spear about as long as width of lip region with distinct, small knobs. Esophagus a somewhat irregular tube, narrowing as it passes through the nerve ring then expanding to the spindle-shaped bulb which bears a long posterior extension reaching back to the intestine. The three esophageal gland nuclei lie within the bulb. Excretory pore usually about opposite base of bulb. Intestine thin walled, its lumen broad. In many specimens the tissues surrounding the bulb extension looked very much like those of the intestine and it may be possible that they form an anterior chamber.

The single out-stretched ovary rarely reaches to the base of the

neck and is made up of oöcytes arranged in single file. Vulva a broad transverse slit from which the vagina extends inward a short distance to join the thin-walled uterus. Oviduct composed of many protruding cells giving it somewhat the appearance of a bunch of grapes. Attached to the anterior end of the oviduct is a short branch which may function as a spermatheca.

Diagnosis: *Paurodontus* with the above measurements and general description. Distinctive because of the tapering neck, straight, pointed tail, and the short branch of the oviduct.

Habitat: Soil about the roots of *Larrea tridentata* (D. C.) Vail., Littlefield, Arizona, U. S. A. Also from soil around roots of barley, Yuma Experiment Station, Bard, California; and cotton, Arvin, California.

Paurodontus niger Thorne, new species

Plate VI, Fig. 15, 15a

♀: 0.4 mm; a = 24; b = 6.3; c = 8; V = $^{40}80^{2}$.

Body tissues even more dense than is usual in this genus, making observation of the organs very difficult. Neck tapering but little to the rounded lip region. Tail conoid to the pointed terminus. Wing area marked by six lines occupying about one-fourth the body width. Lips apparently arranged like those of *Paurodontus densus* (fig. 13). Spear as long as head width, slender and bearing well-developed, symmetrical basal knobs. Esophagus with an irregular cylindrical corpus, narrow isthmus and greatly variable basal bulb which bears an elongated valvular apparatus attaching it to the intestine. Lumen of esophagus very obscure. Intestine with dense, irregular sized granules.

Ovary outstretched, the oöcytes arranged in single file. Eggs fill the body cavity and are about three times as long as wide. Oviduct without a special branching spermatheca as in *Paurodontus apiticus*. Vulva a depressed transverse slit.

Diagnosis: *Paurodontus* with the above measurements and general characters. Most closely related to *P. apiticus* from which it differs in the relatively broader lip region, conspicuous wings and absence of an oviduct branch.

Habitat: Soil about roots of shadscale, *Atriplex confertifolia* (Torr. & Frem.) S. Wats. collected west of Utah Lake, Utah, above the abandoned Mosida irrigation project.

GENUS *STICTYLUS* THORNE, NEW GENUS

Paurodontinae. Characters of the subfamily. Spear with asym-

metrical knobs, the ventrosubmedian ones being much larger than the dorsal one. Tail blunt and rounded. Bursa, where known, enveloping almost the entire tail.

Diagnosis: *Stictylus* is immediately differentiated from *Paurodontus*, its only known relative, by the asymmetrical spear knobs, and blunt tail.

Type Species: *Stictylus asymmetricus* Thorne, new species.

KEY TO SPECIES OF *STICTYLUS*

1. Vulva a depressed slit.....*obtusus* n. sp. p. 55
   Vulva with protuberant labia.....*asymmetricus* n. sp. p. 55

Stictylus asymmetricus Thorne, new species

Plate VI, Figs. 16–16f

♀: 0.8 mm; a = *22*; b = 5.1; c = *27*; V ^{70} 90.
♂: 0.8 mm; a = *27*; b = 5.7; c = 23; T — 65.

The obese body of the female generally assumes an arcuate form. The four lines of the wing area occupy from one-fourth to one-third of the body width. Lip region low, rounded, not set off. The submedian knobs of the spear are much larger than the dorsal one and at first the lumen of the esophagus follows ventrad against them. The outlet of the dorsal esophageal gland appears to empty directly into the base of the spear. Corpus of esophagus generally with a spindle-shaped swelling. Basal extension of the basal bulb variable in length (fig. 16b, 16d). Intestinal cells filled with dense, coarse granules.

Ovary outstretched in young females but usually reflexed a short distance in older ones with an occasional specimen in which it is doubly flexed. Oviduct cellular. Vulva a broad transverse slit with elevated labia. Spicula and gubernaculum tylenchoid. Bursa enveloping the tail almost to the terminus.

Diagnosis: *Stictylus* with the above measurements and general description. Distinguished from *S. obtusus* by the form of the basal esophagus bulb, the shorter tail, and elevated labia of the vulva.

Habitat: Soil about roots of desert plants near the U. S. Field Station, Sacaton, Arizona.

Stictylus obtusus Thorne, new species

Plate VI, Fig. 17, 17a

♀: 1.0 mm; a = 25; b = 6.4; c = 18; V — ^{66} 90.

Cuticle with fine transverse striae. Neck tapering uniformly to the low, rounded lip region. Posteriorly the body tapers to the blunt, rounded tail which is about twice as long as the anal body diameter. The spear is slightly longer than the width of the lip region and is strongly knobbed, the two ventro-submedian knobs being much the larger. Corpus of esophagus with an elongated, spindle-shaped swelling slightly less than one-third as wide as the body. Isthmus slender, surrounded by a very distinct nerve ring. Basal bulb of esophagus ovate, its lumen triquetrous. Basal extension of bulb bluntly-conoid. Intestine with thin walls and scattering, variable-sized granules. At first it is three-fifths as wide as the body but almost immediately is crowded to one side by the ovary. Excretory pore opposite base of esophagus.

Ovary reflexed half way back to vulva with oöcytes arranged in single file. Uterus broad, thin-walled. Vagina extending about one-third the distance across the body, then turned almost at right angles to form an elongated, somewhat funnel-shaped portion connection with the uterus. Vulva a broad depressed slit.

Diagnosis: *Stictylus* with the above measurements and general description. Distinguished from its closets relative, *S. asymmetricus*, by the longer female tail, depressed labia of vulva, long reflexed portion of ovary, and triquetious lumen of the basal esophageal bulb.

Description and figures from notes and sketches made of a single specimen collected May 22, 1923, from soil about the roots of sugar-beets near Lewiston, Utah. Due to the writer's inexperience at that time it may be possible that the recording of a triquetrous, valvular lumen in the esophageal bulb was an error.

Nothotylenchinae Thorne, new subfamily

Tylenchidae. In general form and appearance these nematodes closely resemble those belonging to the genera *Tylenchus* and *Dity-lenchus*. Corpus of esophagus either cylindroid or bearing a fusiform basal swelling without a valvular apparatus. Head framework divided into six sectors. Ovary prevulvar, posterior uterine branch always present. Spicula and gubernaculum tylenchoid.

Diagnosis: *Tylenchidae* without a valvular median esophageal bulb. Distinguished from *Neotylenchinae* by the presence of only six sectors is the cephalic framework. From *Paurodontinae* it is immediately differentiated by the absence of a posterior extension of the basal esophageal bulb.

Type Genus: *Nothotylenchus* Thorne, new genus.

KEY TO GENERA OF *NOTHOTYLENCHINAE*

1. Cuticle abnormally thick and deeply striated. *Thada* n. g. p. 62
   Cuticle not abnormally thick, finely striated..... 2
2. Spear with tylenchoid basal knobs. *Nothotylenchus* n. g. p. 57
   Spear with flange-like basal projections. *Boleodorus* n.g. p. 59

Nothotylenchus Thorne, new genus

Nothotylenchinae: Cuticle thin, marked by fine transverse striae which are interrupted on the lateral fields by a wing area marked by four or more bright lines. Cephalic framework in six sectors. Spear with rounded basal knobs. Corpus of esophagus cylindrical, with or without a fusiform valveless bulb. Basal bulb of esophagus distinctly set off from intestine, sometimes slightly lobed. Anterior ovary outstretched, the oöcytes arranged in single file. Rudimentary posterior uterine branch present. Spicula and gubernaculum tylenchoid. Bursa rising slightly anterior to spicula and extending to near the middle of the tail.

Diagnosis: *Nothotylenchinae* with the above general characters. Distinguished from *Thada* by the thin, finely-striated cuticle and from *Boleodorus* by the rounded basal knobs of the spear.

Type Species: *Nothotylenchus acris* Thorne, new species.

To the uninitiated this group of names presents a puzzling problem, for unless very careful examination is made under the highest powers of the microscope, they may easily be mistaken for *Ditylenchus dipsaci* (Kuhn) Filipjev or *D. intermedius* (deMan) Filipjev, especially since they are so frequently associated with alfalfa crowns where these two species often are found.

KEY TO SPECIES OF *NOTHOLYLENCHUS*

1. Basal esophageal bulb elongate-cylindrical..... .....*cylindricollis* n. sp. p. 59
   Basa esophageal bulb tapering..... 2
2. Terminus acute, wings 4.....*acris* n. sp. p. 57
   Terminus rounded, wings 6.....*affinis* n. sp. p. 58

Nothotylenchus acris Thorne, new species

Plate VII, Figs. 18–18c

♀: 0.9 mm; a = 33; b = 6.2; c = 15.5; V — 40 80.
♂: 0.7 mm; a = 35; b = 6.5; c = 9.5; T — 48.

Body tapering anteriorly until the lip region is only about one-fourth as wide as the neck base. The conoid tail ends in an abruptly conoid, pointed terminus. Wing area marked by four lines which occupy about one-fifth of the body width. Deirids very obscure, located near the base of the neck. Phasmids not seen. Spear slender, the apical portion occupying only about one-third of its length. Basal knobs of spear small, distinct. Corpus of esophagus with a fusiform valveless bulb. Isthmus long, slender, encircled by the conspicuous nerve ring. Lumen of esophagus exceedingly fine (exaggerated in fig. 18), passing through the ventral portion of the basal bulb. Dorsal esophageal gland nucleus large and conspicuous; submedian gland nuclei very small, often invisible. Basal portion of esophageal bulb slightly lobed, extending back over the conoid, valvular apparatus connecting it to the intestine. Intestine with thick walls and narrow lumen. Ovary outstretched with oöcytes arranged in single file. Anterior portion of oviduct forming a spermatheca. Posterior uterine branch two to three times as long as body width. Spicula practically identical to those of nemas of the genus *Tylenchus*. Gubernaculum thin, trough-like. Bursa beginning about opposite the proximal ends of the spicula and extending slightly past the middle of the tail. Testis outstretched.

Diagnosis: *Nothotylenchus* with wing area marked by four lines and tail ending with an abruptly conoid, pointed terminus.

Habitat: Soil about alfalfa crowns, Medford, Oregon, red clover roots, Redmond, Oregon, and sugar-beets, Arvin, California.

Nothotylenchus affinis Thorne, new species

Plate VII, Figs. 19–19c

♀: 0.65 mm; a = 33; b = 5; c = 9; V — 41 71.
♂: 0.64 mm; a = 32; b = 6.4; c = 11; T — 70.

Neck tapering rather uniformly throughout its length until the lip region is about one-half as wide as the neck base. Posteriorly the tails of both sexes taper uniformly to the small rounded terminus. Distance from vulva to anus approximately the same as the tail length. Wing area marked by six refractive lines, the two outer ones being the most prominent. Spear averaging 8 μ long with well developed basal knobs. Esophagus very similar to that figured for *Nothotylenchus acris* (fig. 18c). Ovary outstretched. Posterior uterine branch shorter than the body width. Spicula arcuate, about 15 μ long. Gubernaculum thin, trough-like. Bursa rising about opposite the anterior end of the

spicula and extending to the middle of the tail.

DIAGNOSIS: *Nothotylenchinae* with uniformly tapering neck, six lines in wing area, small rounded tail terminus, very short posterior uterine branch and distance vulva to anus equal to tail length.

HABITAT: Dying alfalfa crowns near Manti, Utah.

NOTHOTYLENCHUS CYLINDRICOLLIS Thorne, new species

Plate VII, Fig. 20, 20a

♀Y: 0.7 mm; a = 34; b = 5; c = 17; V — 53 90.
♂: 0.9 mm; a = 40; b = 5; c = 12; T — 40.

Neck cylindrical except in the anterior third where it becomes convex-conoid and tapers rapidly to the lip region which is only about one-fourth as wide as the neck base. Tails of both sexes tapering uniformly to a pointed terminus. Vulva to anus distance only about half of tail length. Wing area one-third as wide as body, marked by four refractive lines. Spear about 7 μ long with small basal knobs, the width at the knobs being only one-eighth of the head width. Corpus of esophagus cylindroid without any indication of a median swelling or valve. Isthmus about as long as neck width. Basal esophageal bulb cylindroid, three times as long as neck width. Ovary outstretched. Vagina extending in and forward from the depressed transverse vulva. Posterior uterine branch about as long as the body width. Spicula 20 μ long, slightly arcuate. Gubernaculum thin, trough-like. Bursa rising a little anterior to spicula and extending to middle of tail.

DIAGNOSIS: *Nothotylenchus* with basal two-thirds of neck nearly cylindrical, distance vulva to anus only half the tail length, and cylindroid corpus and basal bulb of the esophagus.

HABITAT: Soil and organic debris at base of *Ananas* sp., Paraguay.

GENUS *BOLEODORUS* THORNE, NEW GENUS

NOTHOTYLENCHINAE: Cuticle thin, marked by fine transverse striae about 1 μ apart at tehih widest points. A full set of 16 cephalic papillae probably present. Cephalic framework in six sectors. Spears of known species about 12 μ long with three prominent basal flanges. Corpus of esophagus with fusiform, valveless basal swelling. Basal bulb of esophagus distinctly set off from intestine, not lobed, joined with intestine by a well-developed valvular apparatus. Vulva a transverse slit. Ovary outstretched. Oviduct made up of large cells some of which may form a pouch-like spermatheca. Posterior uterine

branch less than half as long as body width. Spicula and gubernaculum tylenchoid. Bursa only about twice as long as body width.

Diagnosis: *Nothotylenchinae* with long (12 μ) spears bearing basal flanges instead of rounded knobs.

Type Species: *Boleodorus thylactus* Thorne, new species.

Boleodorus thylactus Thorne, new species

Plate VIII, Fig. 21 – 21h

♀: 0.6 mm; a = 31; b = 5.5; c = 8.0; V = $^{36}61^{1.0}$.
♂: 0.5 mm; a = 33; b = 5.0; c = 7.2; T =

Body arcuate when relaxed by gradual heat, the female tail almost always somewhat hooked, male tail straighter. Bodies of fixed specimens always twisted until the head and tail are seen from a slightly submedian view. Cuticle and subcuticle marked by transverse striae which are about 1.0 μ apart near the middle of the body. Wing area a refractive band about one-fifth the body width, bordered by two conspicuous bright lines and bearing two more very faint lines which divide the area into three equal spaces. Deirids slightly posterior to base of neck, phasmids about one body width posterior to anus. Excretory pore with heavily sclerotized tube. Neck tapering gradually to the convex-conoid, unstriated lip region which is much more transparent than the adjacent head. *En face* the lip region is seen to be divided into six sectors, the two lateral ones being very much reduced. The basal portion of the libial framework is obscurely hexagonal.

A study of specimens stained *intra vitam* with neutral red and gentian blue show that apparently there are sixteen cephalic papillae. Six of these are grouped closely about the entrance to the vestibule and are exceedingly difficult to observe; four distinct ones are located near the margins of the submedial lips and six, generally very obscure, are found at the base of the lip region. Of the six at the base of the lip region, the two laterals are somewhat more distinct and located slightly more posteriod than the submedian ones. Amphid apertures minute, oval, located one-third the way back on the lip region. Amphidial tubes and pouches especially conspicuous when stained by neutral red (fig. 21c).

Vestibule strongly sclerotized. Spear 12 μ long, the distal portion being about 4 μ long. Basal knobs of spear distinctly flange-like and from a lateral view the spear frequently has a trifurcate appearance. Outlet of dorsal esophageal gland near base of spear. Corpus of

esophagus at first tubular then expanding to form an elongate-fusiform bulb in which the reservoirs and openings of the two submedian esophageal glands are located. Isthmus slender, gradually expanding to form the basal bulb which contains the large dorsal gland nucleus. The submedian gland nuclei were not definitely observed. A small valvular apparatus connects the esophageal lumen with the thick-walled intestine. Intestine two cells in circumference, containing scattered, refractive granules. Rectum slightly longer than anal body diameter, ending in a distinct anus.

Vulva a transverse slit. Vagina extending half way across body. Anterior ovary outstretched, the oöcytes arranged in single file. Posterior uterine branch rudimentary, half as long as body width. Oviduct composed of columnar cells. Just after fertiization the spermatoza are found in the lumen of the oviduct but soon the fifth dorsal cell from the uterus enlarges to form a sac-like spermatheca, hence the specific name *thylactus* (pouch). Testis single, outstretched. Spicula slender, arcuate, slightly cephalated. Gubernaculum a thin curved trough. Bursa about twice as long as anal body diameter with crenate border.

Diagnosis: *Boleodorus* with ventrally arcuate body and hooked female tail tapering uniformly to an acute terminus.

Habitat: Cultivated soil, especially about alfalfa crowns, Salt Lake, Utah and San Pete Counties of Utah, Ft. Collins and Grand Junction, Colorado, Twin Falls and Caldwell, Idaho, Fallon, Nevada, and Albion, California.

Boleodorus clavicaudatus Thorne, new species

Plate VIII, Fig. 22–22b

♀: 0.7 mm; a = 31; b = 5.7; c = 8.5; V = ^{30}60.

Cuticle marked by fine transverse striae which are about 1 μ apart at their widest points. Wing area about one-third as wide as the body, bordered by two bright refractive lines with two less prominent ones between them. Body tapering rather uniformly until the lip region is only about one-third as wide as the neck base. Tail uniformly conoid to the slightly clavate terminus. Spear 13 μ long with broad basal flanges. Details of esophagus as illustrated (fig. 22b), the basal bulb being only a little longer than the neck width. Excretory pore about opposite base of esophagus.

Ovary outstretched, very short in the five young females examined. Spermatoza were present in the oviduct of two specimens and it ap-

peared as if a spermatheca was forming as in *B. thylactus*. Vulva a depressed slit. Posterior uterine branch similar to that of *B. thylactus* (fig. 21g).

Diagnosis: *Boleodorus* with rather straight body and elongated clavate tail which readily distinguishes it from *B. thylactus*.

Habitat: Soil about alfalfa crowns, Yuma Experiment Station, Bard, California.

GENUS *THADA* THORNE, NEW GENUS

Nothotylenchinae. Very small nemas with abnormally thick cuticle marked by deep, transverse striae and sometimes also by similar longitudinal ones. Cephalic framework in six sectors. Spear with or without basal knobs. Esophagus with plain cylindroid corpus and slender isthmus. Esophageal gland nuclei within the definitely set off elongate basal bulb. A cap-like valvular apparatus occupies the anterior end of the intestine, connecting it with the esophagus. Ovary outstretched, the oöcytes arranged in single file. Posterior uterine branch shorter than body width. Spicula arcuate, cephalated by avoid expansion. Gubernaculum thin, trough-like. Bursa thick, without supporting ribs, extending an equal distance before and behind the anus.

Diagnosis: *Nothotylenchinae* of small size with unusual thick, deeply striated cuticle, cap-like valvular apparatus joining intestine and esophagus and ovate cephalation of the spicula.

Type Species: *Thada striata* Thorne, n. sp.

The name *Thada* has no significant meaning, merely being an arbitrary combination of letters.

KEY TO SPECIES OF *THADA*

1. Cuticle marked by only transverse striae. . . . *striata* n. sp. p. 62
   Cuticle marked by both transverse and longitudinal striae
   . . . . . *cancellata* n. sp. p. 63

Thada striata Thorne, new species

Plate IX, Fig. 23–23e

♀: 0.65 mm; a = 30; b = 6.0; c = 9.0; V = $^{37}71^{2}$.
♂: 0.52 mm; a = 26; b = 5.2; c = 8.0; T = 48.

Body practically cylindrical between vulva and base of neck; anteriorly tapering rapidly to the convex-conoid head until the lip region is about one-fourth as wide as the base of the neck. Posteriorly the body tapers rather uniformly to the conoid, bluntly rounded, tail. On

many specimens there was a slight enlargement or swelling of the tail near its middle and in some instances this condition was rather prominent and may indicate that the deformity is due to some disease. The thick cuticle is cut by deep transverse striae which are coarser on the female than on the male. The wing area is marked by four conspicuous refractive wings which at midbody occupy from one-third to three-fifths the body width. Anteriorly the wing area ends in two rows of plates (Fig. 23c). On the tail the wings vary greatly in their arrangement from the symmetrical form (fig. 23d) to the somewhat spiral (fig. 23e). The latter type is found on the tails which bear swellings.

There are six lips, the lateral ones being distinctly smaller than the submedian. Details of the basal knobs of the slender spear are difficult to observe. The esophagus and its valve are practically identical to those of *Thada cancellata* (fig. 24e). The narrow lumen of the intestine is about as wide as the thickness of the body cuticle.

Vulva a broad transverse slit. Oviduct forming a spermatheca in its anterior portion. Ovary outstretched, the oöcytes arranged in single file. Posterior uterine branch shorter than body diameter.

Spicules arcuate, cephalated in a typical form (fig. 23b). Gubernaculum a thin curved plate. Bursa very thick, without crenate borders except near body. The single testis is reflexed a distance equal to one or two body widths.

Diagnosis: *Thada* with transversely striated cuticle, not marked by longitudinal striae as in *T. cancellata*.

Type Habitat: Desert soil about roots of shadscale, *Atriplex confertifolia* (Torr. & Frem.) S. Wats., collected west of Utah Lake, Utah, above the abandoned Mosida irrigation project. Also from alfalfa crowns, Brown's Ranch, Skull Valley, Utah.

Thada cancellata Thorne, new species

Plate IX, Fig. 24 – 24e

♀: 0.52 mm; a = 25; b = 5.4; c = 8; V — $^{20}66^{2}$.

Body practically straight when relaxed by gradual heat. Cuticle marked by 155 to 175 deep transverse striae. At midbody there are 16 longitudinal striae, the number decresing toward the extremities. There are four prominent wings which alter on the neck and tail as shown in figs. 24a, b. Deirids and excretory pore prominent, located opposite the basal esophageal bulb. Phasmids not seen. The numbers of lips and papillae on the low rounded head could not be determined

from a lateral view but are probably the same as in *Thada striata*. Vestibule and pharynx sclerotized. Spear exceedingly slender, its basal portion obscured by the muscle attachments until it was not possible to determine if basal knobs were present. Esophagus as shown in fig. 24c. Two small ampullae in the corpus apparently mark the outlets of the submedian esophageal glands. The nucleus of the dorsal esophageal gland is easily seen near the middle of the bulb but the submedian gland nuclei are very small and obscure, one apparenty lying back near the base of the bulb. Anterior end of intestine bearing a distinct valvular apparatus. Ovary only 4 or 5 body widths long, containing about a dozen oöcytes arranged in single file. Anterior portion of oviduct serving as a spermatheca. The short uterus and oviduct combined are about as long as the ovary. Vulva a deep transverse slit. Posterior uterine branch vestigial, half as long as the body width. Males unknown but the two females collected both contained spermatozoa, therefore males probably exist.

Diagnosis: *Thada* with longitudinal as well as transverse striae.

Type Habitat: Soil from sugar-beet field, Fort Collins, Colorado; collected by John O. Gashill, U. S. Sugar Plant Investigations.

GENERA AND SPECIES OF DOUBTFUL POSITION

GENUS *HALENCHUS* COBB, 1933

Tylenchidae. Junction of esophagus and intestine indefinite. Terminus of tail ventrally hooked. Spear smaller in male. Marine.

Type Species: *Halenchus fucicola* (deMan, 1892) N. A. Cobb, 1933.

Synonym: *Tylenchus fucicola* deMan, 1892.

DeMan very plainly figures the elongated esophageal gland, with its large nucleus, extending back beside the intestine in a manner similar to that of *Deladenus durus*. The position of this genus is doubtful and until more definite information is available it is deemed best to leave it directly under the *Tylenchidae*.

Halenchus fucicola (deMan, 1892) Cobb, 1933

Plate IX, Fig. 26

♀: 1.25–1.45 mm; a = 45–50; b = 5–6; c = 11–13; V = 60–64.
♂: 1.10–1.25 mm; a = 45–60; b = 5–6; c = 11–13.

With characters of the genus. Cuticle with fine transverse striae. Spear 1/13 – 1/15 the length of the esopragus. Excretory pore at abou:

12%. Ovary outstretched. A short, rudimentary uterine branch present. Vulva with slightly elevated lips. Eggs about twice as long as body width. Testes outstretched. Bursa rising slightly anterior to spicula and extending to near middle of tail.

Host: *Fucus (Ascophyllum) nodosus*, a brown seaweed.

Distribution: East and west coast of Scotland, at Stonehaven and the mouth of the river Clyde, Ayshire coast and at Port Erin, Isle of Man. Specimens apparently identical but with slightly shorter neck. b = 6.6, collected at Woods Hole, Mass.

References: 5, 15.

Halenchus mediterraneus (Micoletzky, 1922) Cobb, 1933

Synonym: *Tylenchus mediterraneus* Micoletzky, 1922.

♀: 0.81 mm; a = 40; b = 7.8; c = 10.6; V — 69.5.
♂: 0.56–1.1 mm.

Similar in many respects to *H. fucicola* but smaller in size. Spear 1/9 – 1/7 the esophageal length. Bursa about three times as long as anal body diameter extending the same distance in front of the anus as behind it.

Habitat: Free-living among algae on the coasts of Mediterranean, Red Sea and Sea of Marmora.

References: 5, 18.

Tylenchus arboricolus Cobb, 1922

♀: 0.7 mm; a = 20; b = 12.5; c = ?; V — ^{70}87.
♂: 0.7 mm; a = 24; b = ?; c = 23.

Striae plain, about 1 μ apart except at extremities where they are closer together. Neck to the amalgamated lip region which is 7 μ wide and 2.5 μ high and set off by a constriction. Spear faintly knobbed. Esophagus with a vestigial, valveless, median swelling about half as wide as the neck. Length of esophagus questionable. Intestine thick walled. Tail of female straight, convex conoid to the acute symmetrical terminus. Ovary at first broad, then tapering to the blind end which is reflexed a short distance. Oöcytes generally arranged in an irregular manner.

Male tail resembling that of female. Spicula arcuate distally, straight in proximal part where they are two-fifths to one-third as wide as the body. Gubernaculum faintly developed if present at all. Bursa without ribs, rising two-thirds of body width in front of anus

and enveloping all but the very tip of the tail. Testis reflexed about three body widths.

Habitat: Numerous in blister-like structures on leaves of beech, *Fagus obliqua* Mirb., Santiago, Chile.

Unfortunately figures were not published with the description of this species. The indefinite ending of the esophagus and the apparent absence of an ovate valvular apparatus in the corpus of the esophagus indicate that it may be near to *Deladenus obesus.*

Anguillonema pinguicauda Fuchs, 1938

Plate IX, Fig. 27, 27a

♀: 0.632 mm; a = 27.5; b = 5.0; c = 22.5; V = 90.9.
♂: 0.501 mm; a = 33.0; b = 5.0; c = 19.0.

Spear with somewhat divided base. Esophagus with a large gland lying parallel to the basal bulb. Female tail tapering to a blunt, cylindrical or slightly clavate terminus. Spicula and gubernaculum tylenchoid. Bursa enveloping the tail.

Probably this species belongs in *Neotylenchus* but accurate designation is impossible without specimens.

ABBREVIATIONS USED IN ILLUSTRATIONS

al.....wings
amph.....amphidial apertures
br.....branch
brs.....bursa
ch.....chamber of corpus
cor.....corpus
gl sal dal...dorsal salivary gland
gub.....gubernaculum
jnc.....junction of intestine and esophagus
ncl.....nucleus of dorsal esophageal gland
nrv r.....nerve ring
oe gl op....esophageal gland opening
ov dct.....oviduct
on.....spear
ovr.....ovary
p ex.....excretory pore
ppl.....papillae
rud.....rudimentary
sp.....spiculum
spthc.....spermatheca
ut.....uterus
vlv.....vulva

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Plate I *

Fig. 1, 1a. *Neotylenchus abulbosus* Steiner. 1, anterior portion of body, x 400; 1a, posterior portion of male, x 600. After Steiner.

Fig. 2. *Neotylenchus consobrinus* (deMan). 2, head. After Goodey.

Fig. 3 – 3c. *Neotylenchus apiculatus* n. sp. 3, head; 3a, anterior portion of body; 3b, posterior portion of female; 3c, double flexure of ovary.

Fig. 4, 4a. *Neotylenchus latus* Thorne. 4, cephalic framework showing relative positions of papillae and amphids; 4a, posterior portion of female, x 375.

Fig. 5, 5a. *Neotylenchus obesus* Thorne. 5, head, x 1500; 5a, female tail, x 500.

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* Unless stated otherwise all lateral and *en face* figures of heads and cephalic frameworks are x 2000 and other portions of bodies are x 750.
All figures are original unless stated otherwise.

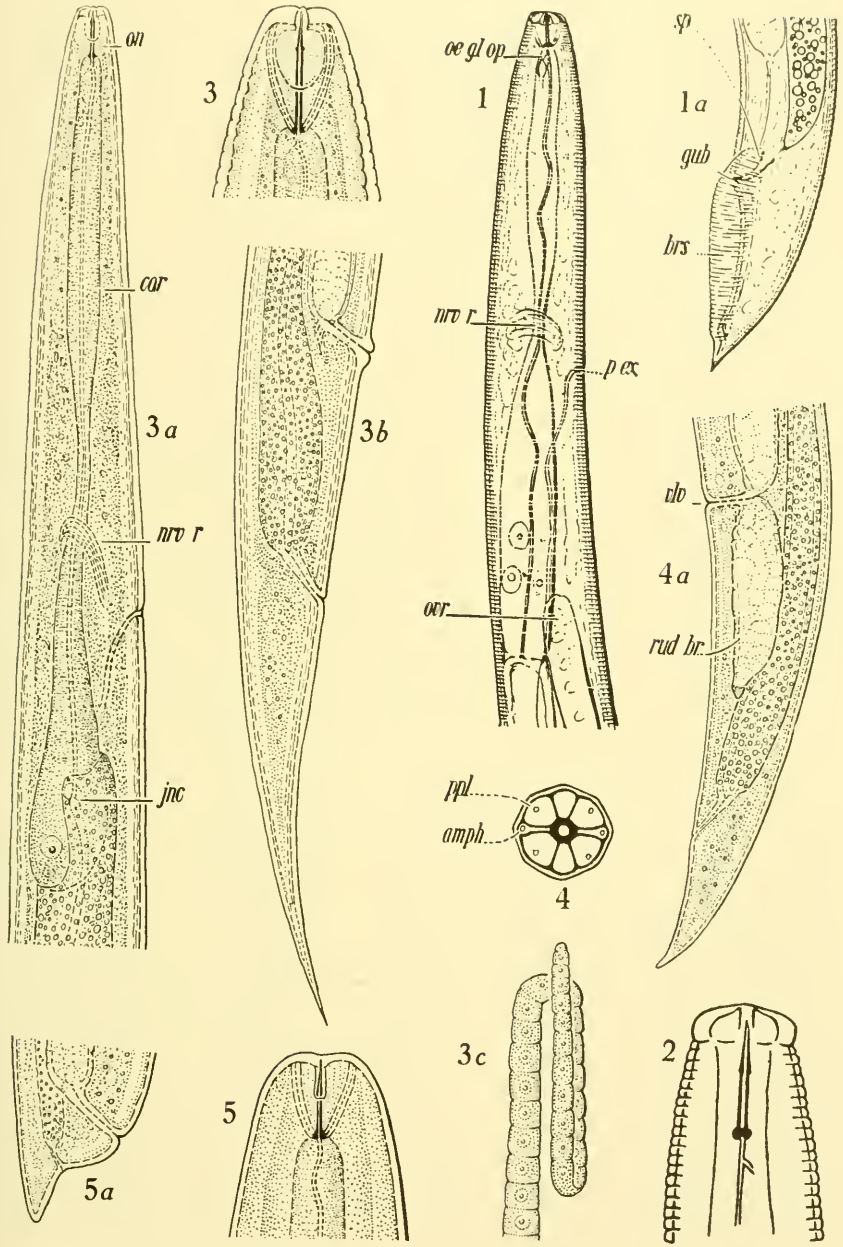
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PLATE I

Plate II

Fig. 6 – 6d. *Neotylenchus arcuatus* n. sp. 6, head, 6a, posterior portion of female, x 500; 6b, posterior portion of male, x 500; 6c, six lines of wing area; 6d, anterior portion of body.

Fig. 7 – 7i. *Deladenus durus* (Cobb). 7, anterior portion of body; 7a, *en face* of lip region; 7b, cephalic framework; 7c, ventral view of posterior portion of male, x 500; 7d, cross section of wing area, x 1000; 7e, head; 7f, posterior portion of female from Oregon; 7g, portion of intestinal lumen; 7h, posterior portion of female from *Pleurota* sp.; 7i, variations in termini of females from *Pleurota* sp.

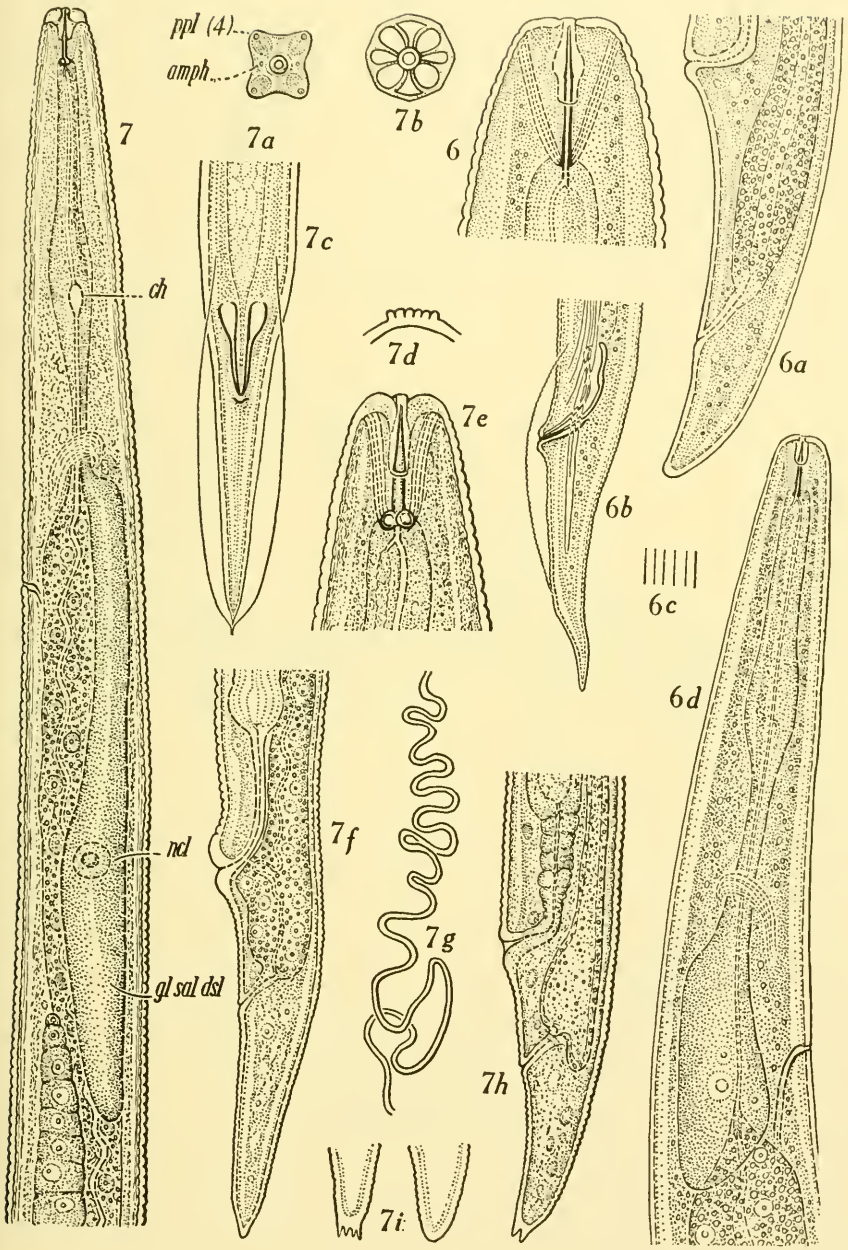

PLATE II

Plate III

Neotylenchus intermedius (Christie), n. combt.

A – Female. B – Head, *en face* view. C – Tail of male, lateral and ventral views.

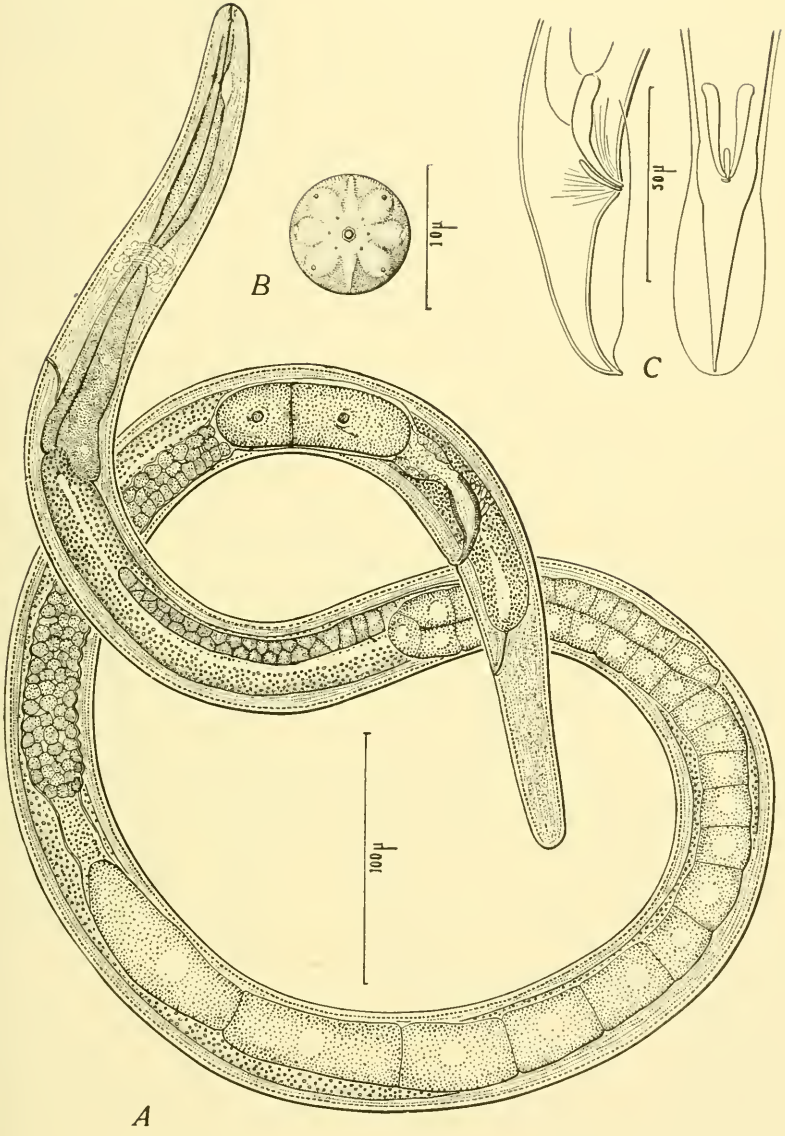

PLATE III

Plate IV

Fig. 8 – 8c. *Deladenus obesus* n. sp. 8, head; 8a, cephalic framework showing relative positions of papillae and amphids; 8b, anterior portion of body; 8c, posterior portion of body.

Fig. 9 – 9d. *Hexatylus vipiparus* Goodey. 9, *en face* of cephalic framework pattern; 9 a, cephalic framework; 9b, head; 9c, anterior portion of body; 9d, posterior portion of female, x 500.

Fig. 10 – 10a. *Hexatylus fungorum* (Bütschli). 10, posterior portion of female, x ?; 10a, posterior portion of male, x ?; After Bütschli.

Fig. 11 – 11b. *Iotonchium imperfectum* (Bütschli). 11, head; 11a, posterior portion of female; 11b, spiculum, x ? on all figures. After Bütschli.

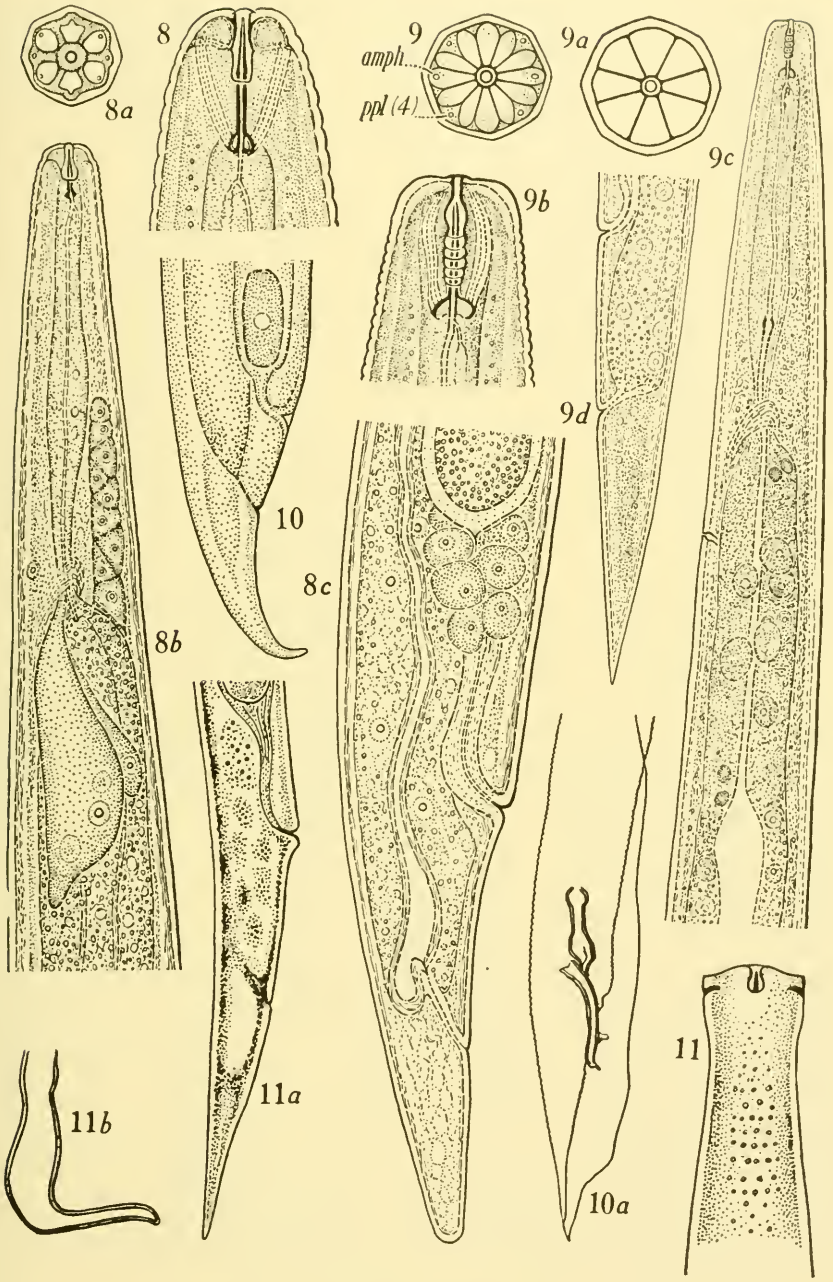

PLATE IV

Plate V

Fig. 12 – 12c. *Paurodontus gracilis* n. sp. 12, *en face*; 12a, anterior portion of body; 12b, posterior portion of male; 12c, posterior portion of female; 12d, cephalic framework.

Fig. 13 – 13d. *Paurodontus densus* n. sp. 13, *en face*; 13a, anterior portion, x 1500; 13b, posterior portion of female, x 1000; 13c, section showing wing area, x 1000.

Fig. 14 – 14d. *Paurodontus apiticus* n. sp. 14, anterior portion of body, x 1000; 14a, reproductive system of female from the vulva through the oviduct; 14b, posterior portion of female, x 500; 14c, oviduct of very young female; 14d, head.

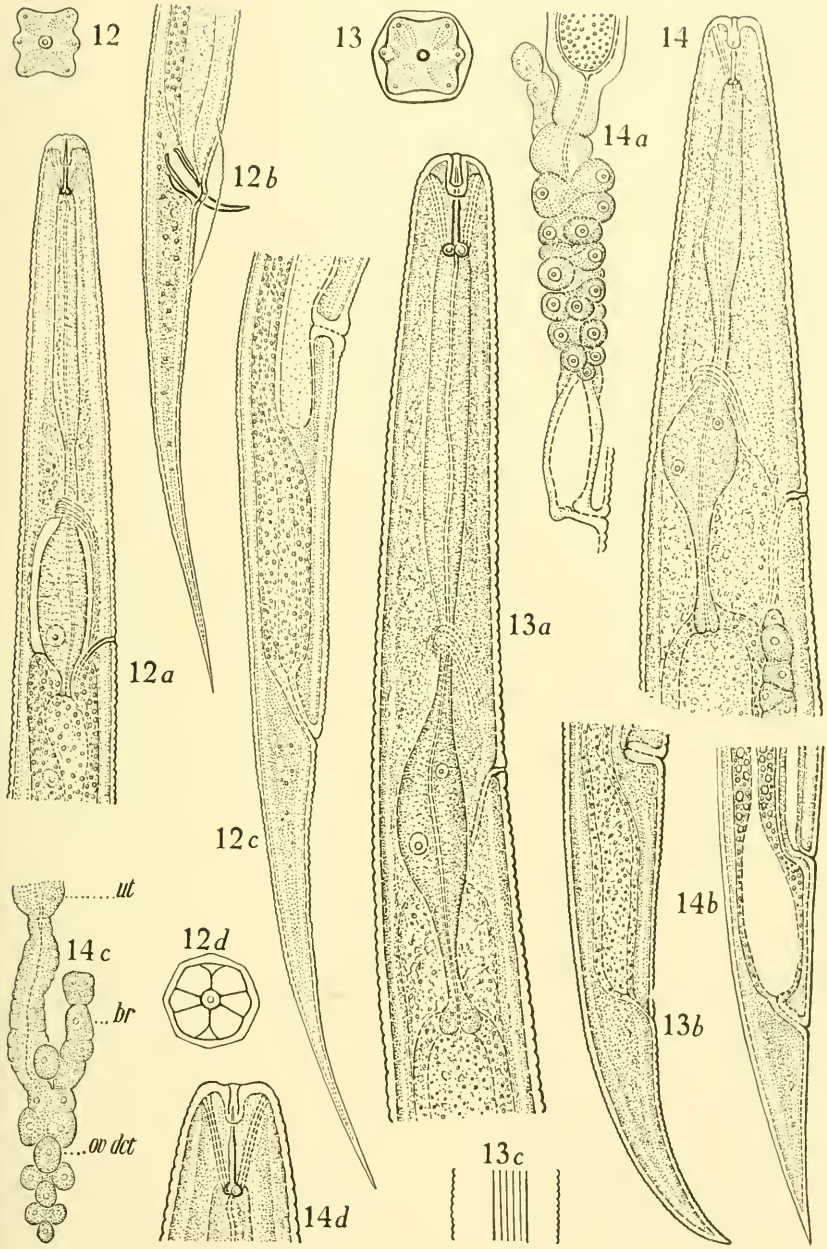

PLATE V

Plate VI

Fig. 15, 15a. *Paurodontus niger* n. sp. 15, anterior portion of body, x 1000; 15a, posterior portion of female.

Fig. 16–16f. *Stictylus asymmetricus* n. sp. 16, *en face;* 16a, head; 16b, variation in basal esophageal bulb; 16c, posterior portion of body; 16 e, posterior portion of male; 16f, section showing wing area.

Fig. 17, 17a. *Stictylus obtusus* n. sp. 17, anterior portion of body; 17a, posterior portion of female, x 500.

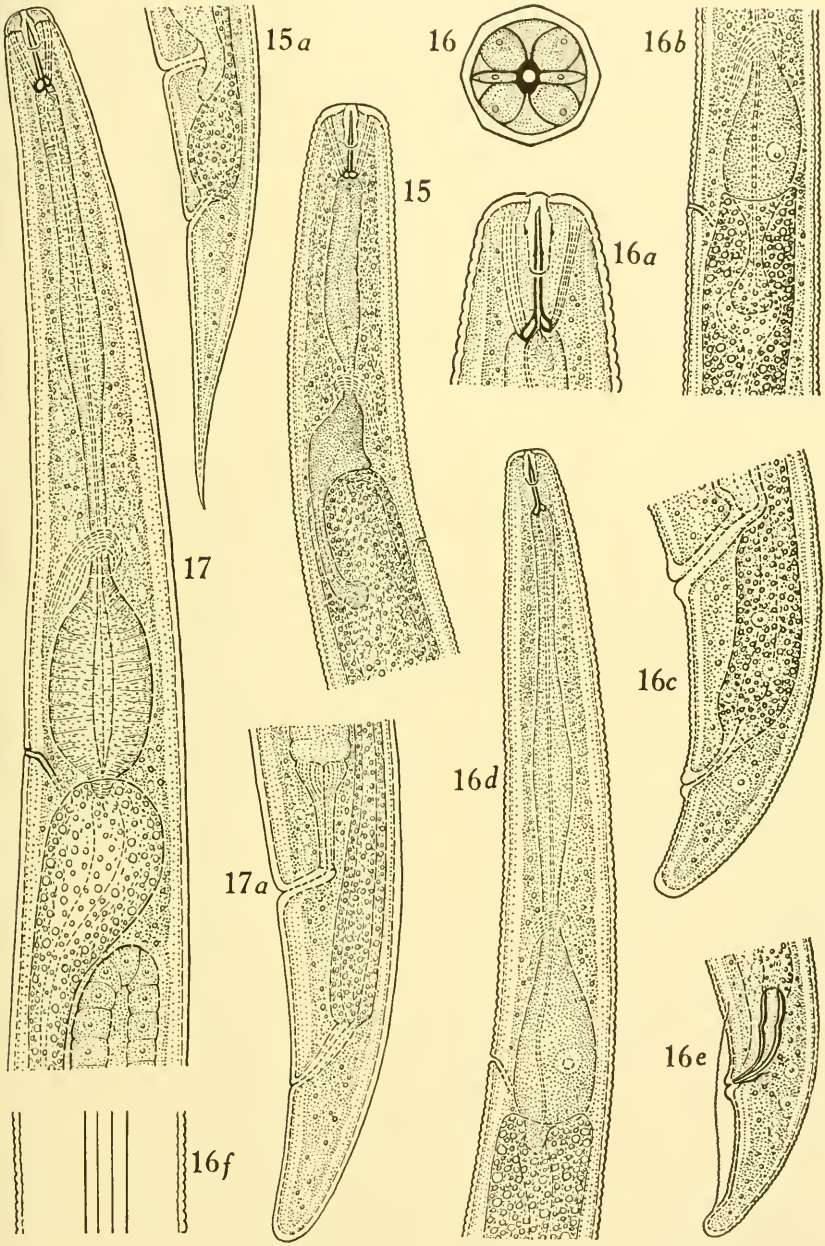

PLATE VI

Plate VII

Fig. 18 – 18c. *Nothotylenchus acris* n. sp. 18, anterior portion of body; 18a, posterior portion of female; 18b, posterior portion of male; 18c, body section showing wing area.

Fig. 19 – 19c. *Nothotylenchus affinis* n. sp. 19, head; 19a, cephalic framework; 19b, posterior portion of female; 19c, posterior portion of male, a1, adjacent section of wing area.

Fig. 20, 20a. *Nothotylenchus cylindricollis* n. sp. 20, anterior portion of body; 20a, posterior portion of female.

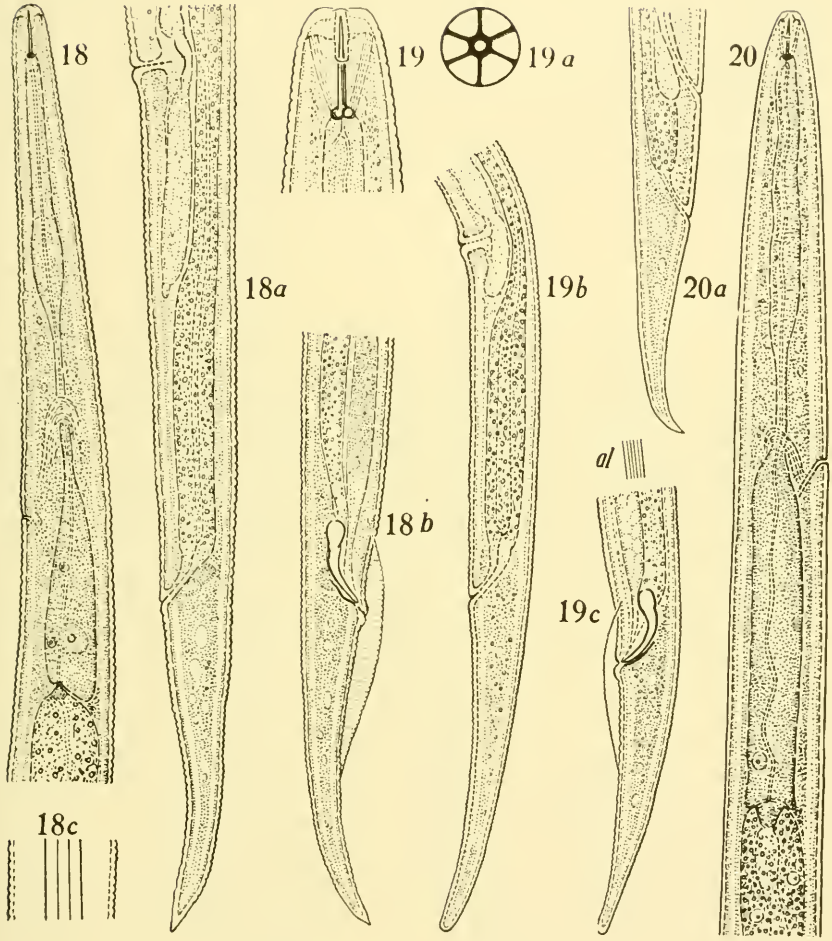

PLATE VII

Plate VIII

Fig. 21 – 21h. *Boleodorus thylactus* n. sp. 21, cephalic framework; 21a, *en face;* 21b, head; 21c, amphidial system in profile as seen when stained by neutral red; 21d, dorso-ventral view of corpus showing outlets of submedian esophageal glands; 21e, section through spear base, x 2000; 21f, anterior portion of body, x 1000; 21g, posterior portion of female, x 500; 21h, posterior portion of male, x 1000.

Fig. 22 – 22b. *Boleodorus clavicaudatus* n. sp. 22, head; 22a, female tail; 22b, portions of esophagus and intestine.

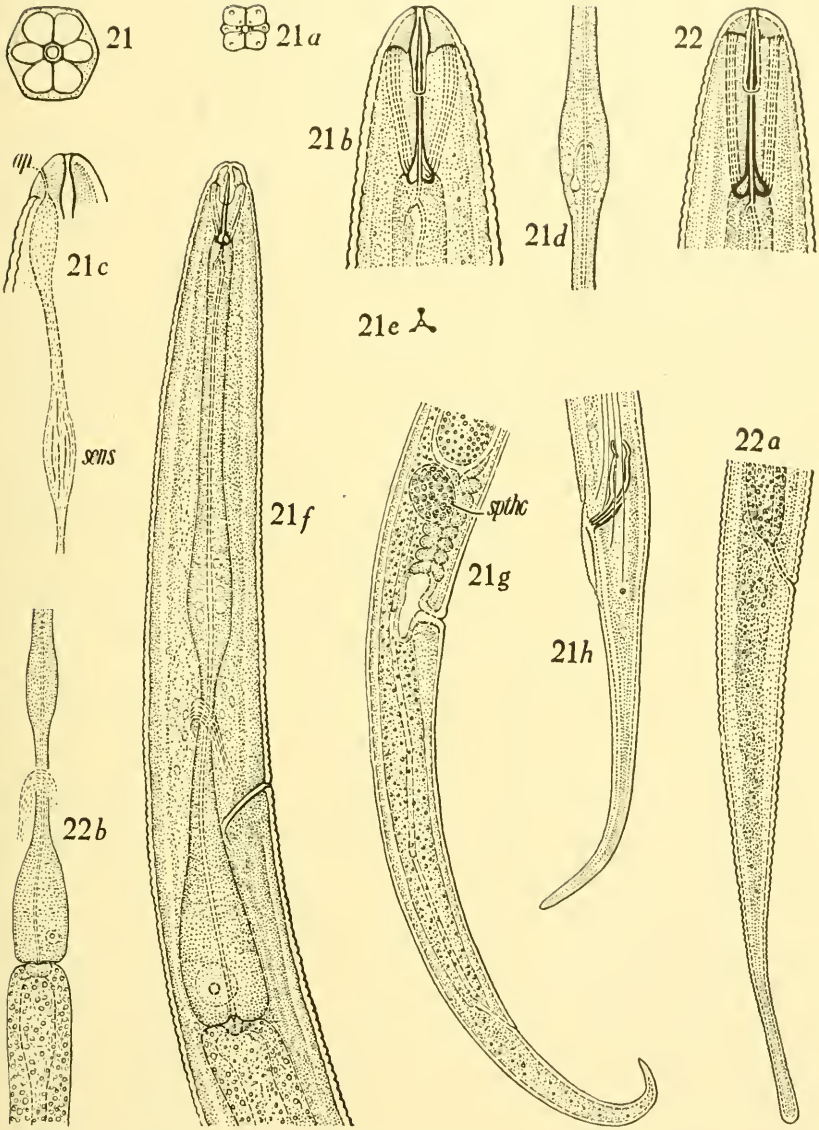

PLATE VIII

Plate IX

Fig. 23 – 23e. *Thada striata* n. sp. 23, *en face;* 23a, head; 23b, posterior portion of male, x 1000; 23c, anterior portion of body, x 1000; 23d, posterior portion of female, x 1000; 23e, posterior portion of diseased female, x 1000.

Fig. 24 – 24c. *Thada cancellata* n. sp. 24, head; 24a, anterior portion of body, x 1200; 24b, posterior portion of female, x 1200; 24c, esophageal system, x 1200.

Fig. 25. *Neotylenchus coprophagus* Goodey. 25, anterior portion of body, x 900. After Goodey.

Fig. 26. *Halenchus fucicola* (deMan). 26, characteristic hooked terminus. After deMan.

Fig. 27, 27a. *Anguillonema pinguicauda* Fuchs. 27, anterior portion of body, x 700; 27a, posterior portion of female, x 700. After Fuchs.

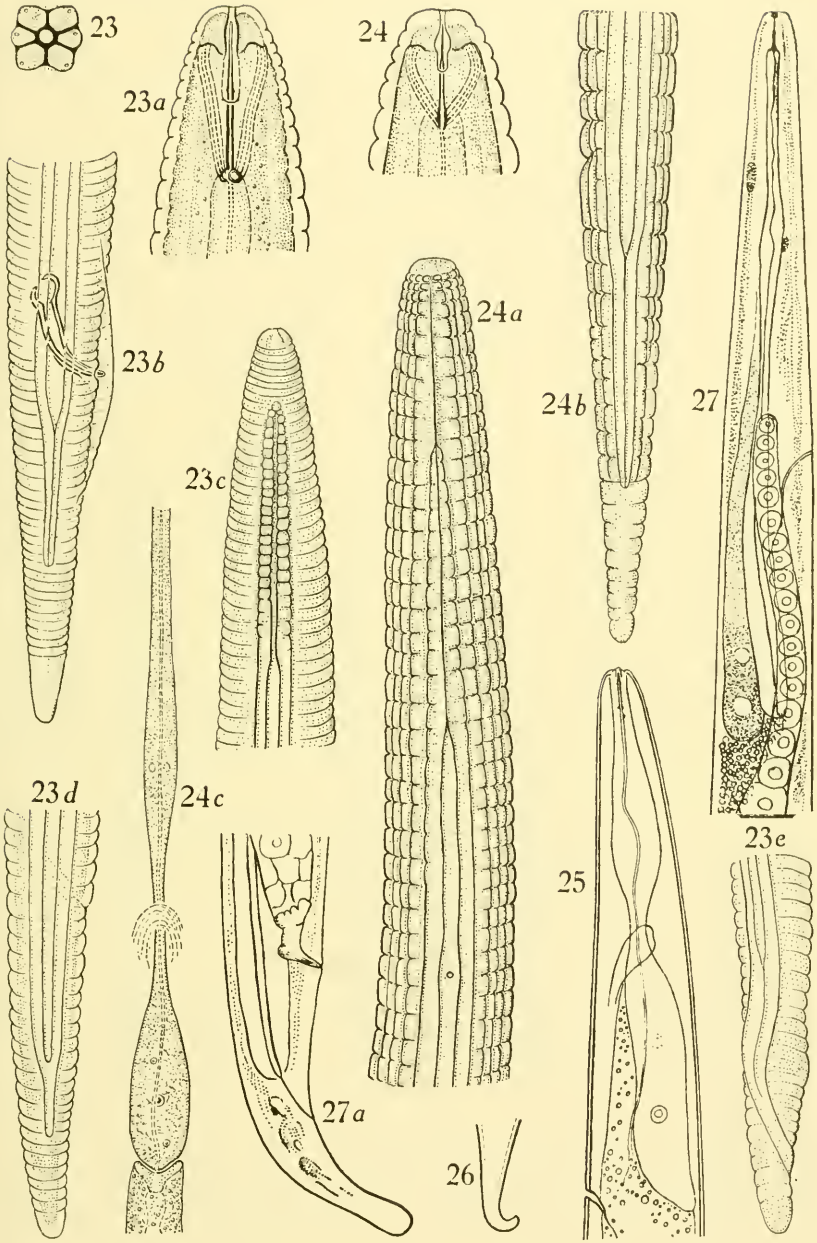

PLATE IX

Lesser Yellow Legs, New Record for Washington County, Utah

Due to the unusually heavy rainfall this spring in Washington County a rather large playa lake developed, four miles south and west of Hurricane, Utah. This lake was visited Tuesday afternoon, May 6, 1941 by Mr. Nelson Snow, Biology instructor in the Hurricane High School, Mr. Jay King, a senior student of the High School interested in zoology, and the writer. We were surprised to find the following large number of shore birds feeding in this lake. With the aid of field glasses we were able to count the numbers of the various species. I was uncertain as to the identity of two species, so we collected specimens with the 410-gauge shotgun. The following is a list of the species on the lake on the above date:

Plegadis guarauna (L.). White-faced Glossy Ibis. A flock of 14 specimens were around the shore. They were quite wild taking to the air as we approached. The other species of this list were too busy feeding to be frightened away.

Capella delicata (Ord.). Wilson Snipe. There were at least 30 individuals of this species feeding in various parts of the lake.

Catoptrophorus semipalmatus inornatus (Brewster). Western Willet. There were 15 specimens of this species.

Totanus flavipes (Gmelin). Lesser Yellow-legs. There was a flock of 20 specimens of this species. Three specimens were collected and are now in the Brigham Young University vertebrate collection. This species is not reported by Mr. Ross Hardy and H. G. Higgins, (An Annotated Check-list of the Birds of Washington County, Utah, Proc. Ut. Ac. Sci. Vol. 17, pp. 95-111, 1940) in their valuable paper on the birds of Washington County. This appears to be a new record for this county of Utah.

Ereunetes mauri Cabanis. Western Sandpiper. There were 30 to 40 sandpipers on the lakes. One specimen was collected and is now in the Brigham Young University vertebrate collection.

Recurvirostra americana Gmelin. Avocet. There were 25 to 30 avocets on the lake.

Himantopus mexicanus (Muller). Black-necked Stilt. Only 5 specimens of this interesting wadder were on the lake.

This is the first time that large flocks of most of these species have been observed in this county. Most of the records are based upon a few migrants observed along the Virgin River.—V. M. T.

THE REPTILES AND AMPHIBIANS OF IDAHO NO. 1[1]

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Provo High School, Provo, Utah

INTRODUCTION

In the present paper, first of a series of papers on Idaho reptiles, an attempt has been made to bring together information on the amphibians and reptiles of Idaho. This work has been in progress for many years and is an outgrowth of many collecting trips, not only by the author but by many of the Idaho students and other workers who have collected reptiles from various Idaho localities and have deposited them in the Brigham Young University vertebrate collection. In fact this work was started in 1928 when Dr. Vasco M. Tanner and a group of students spent several weeks in southern Idaho. At about the same time Mr. Richard P. Erwin was working on the reptiles of western Idaho and sent over a hundred specimens to the Brigham Young University. During the past few years additional information has been added and it now seems desirable to list the known records for the state.

Besides those specimens found in the Brigham Young University I am indebted to the following for the use of specimens, notes or for suggestions: Dr. Victer E. Jones, University of Idaho Southern Branch at Pocatello; Prof. O. H. Smith, College of Idaho at Caldwell; Mrs. Ora B. Hawkins, Historical Society of Idaho at Boise; Mr. L. M. Klauber, Natural History Museum, San Diego; and to Dr. Vasco M. Tanner and Dr. D. E. Beck at the Brigham Young University.

The writer has found the work of Mr. Richard P. Erwin very helpful, in studying the distribution of species in southwestern Idaho.

AMPHIBIA

AMBYSTOMA MACRODACTYLUM Baird. The Long-toed Salamander

Specimens taken by Mr. Erwin were mostly from Ada County.

AMBYSTOMA TIGRINUM SLATERI Dunn

PUBLISHED RECORDS: Latah and Kootenai counties, (Dunn 1940).

REMARKS: Larval taken at Island Park and Warm River, Fremont County, and two specimens from Madison County are doubtful. It is more likely that these specimens belong to *tigrimum slateri.*

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(1) Contribution No. 92—from the Department of Zoology and Entomology —Brigham Young University, Provo, Utah.

Ambystoma tigrinum nebulosum Hallowell

Published Records: McCammon, Bannock Co., (V. M. Tanner 1931).

Remarks: Dr. E. R. Dunn in his recent paper, "Races of Ambystoma tigrinum," suggests that this species should occur in southern Idaho and possibly larvae from "Snake River" and one from Malad (Oneida Co.) may belong here." Specimens collected in southern Idaho are two few in number to make a careful distributional study at this time.

Plethodon idahoensis Slater & Slipp. The Idaho Salamander

Five specimens were collected by Prof. James R. Slater and Mr. John W. Slipp from the northeast corner of Coeur D'Alene Lake, Kootenai County, Idaho. This appears to be the first amphibian to be described from an Idaho locality.

Dicamptodon eusatus (Eschscholtz). The Pacific Giant Salamander

Five specimens were collected in Mannering Creek, near Highway 95A, 12 miles north of Harvard, Benewah County, Idaho, by Prof. J. R. Slater and Mr. J. W. Slipp. These specimens are believed to be the first reported for Idaho.

Ascaphus truei Stejneger. The American Bell Toad

Published Records: One mile north of Health, Cuddy Mts., Washington Co.; and one half mile east of Black Lake, Adams, Co.; (Linsdale 1933). Mannering Creek, near Highway 95A, 12 miles north of Harvard, Benewah County. (Slater & Slipp 1940).

Scaphiopus intermontanus Cope. The Spade Foot Toad

Published Records: Blackfoot Fork, (Cope 1871); Boise and Kauna Cave, Ada Co.; (Erwin 1928); Boise, Ada Co., (V. M. Tanner 1939).

Remarks: This species occupies the southern parts of Idaho and north to the vicinity of Benewah County. The status of the specimens to the north is in doubt. Dr. Vasco M. Tanner in his recent paper "A Study of the Genus Scaphiopus" indicates the possible occurrence of *Scaphiopus hammondii* in Kootenai and Bonner Counties. Dr. Tanner assured me that specimens collected in northwestern Montana and northeastern Washington were *hammondii*. The extension of this species into Montana indicates that it may be found in northern Idaho.

Bufo boreas boreas (Baird & Girard). The Northwestern or Mountain Toad

Published Records: Clark's Fork, lower Kootenai River, Bonner Co.; Blue Lake, Mount Carlton, Kootenai Co.; Payette Lake and

McCall, Valley Co.; Boise, Ada Co.; Atlanta, Elmore Co.; Alturas Lake and Sawtooth, Custer Co.; between Blue Lake and Shoshone Falls, Jerome Co.; Mink Creek near Pocatello, Bannock Co.; Deep Lakes and Bloomington Canyon, Bear Lake Co., (Slevin 1928). Fairfield, Camas Co. (W. W. Tanner 1940).

New Records: Madison County, George Marler Sept. 9, 1926. Three miles south of Cascade, Valley Co., Wilmer W. Tanner Aug. 16, 1940.

Remarks: Mr. R. P. Erwin reports this species as "very common" in southwestern Idaho. This toad is common in nearly all parts of Idaho.

Pseudacris nigrita triseriata (Wied). The Three-striped Tree Frog

Published Records: Nampa, Canyon Co.; Boise, Ada County; (Slevin 1928). Driggs, Teton County; (V. M. Tanner 1931). Delco, Cassia County; (W. W. Tanner 1940).

Remarks: I have observed this little frog all along the Snake River from Kimberly, Twin Falls County, to Burley, Cassia County.

Hyla regilla Baird & Girard. The Pacific Tree Frog

Published Records: Payette Lake and Lardo, Boise Co.; Boise, Ada Co.; (Slevin 1928).

Remarks: In reporting this species for southwestern Idaho in 1928 Mr. R. P. Erwin regards it as "very common" and adds, "Found scattered all over the country, even in the mountains or anywhere the ground is moist or there is sufficient moisture in the atmosphere." That this species is numerous in and around Boise, Ada Co., I have no doubt; last summer (Aug. 17, 1940) three specimens were collected in a flower garden and others could be heard in all the adjoining lots and fields.

Rana catesbeiana Shaw. Bull Frog

Reported as common in and around Boise, Ada County, by both Erwin and Slevin 1928. Mr. Erwin says that this frog was "introduced from the east into Idaho in 1890 by W. H. Ridenbough, of Boise."

Rana pipiens Schreber. The Leopard Frog

Published Records: Sand Point and Hope, Bonner Co.; Weiser, Washington Co.; Caldwell, Canyon Co.; Boise, Ada Co.; Mountain Home, Elmore Co.; Spring Branch just above Shoshone Falls, Jerome Co.; Black Foot & Fort Hall, Bingham Co.; American Falls, Power Co.; Deep Lake and Bloomington Canyon, Bear Lake Co.; (Slevin 1928). Warm River, Island Park and Big Springs, Fremont Co.;

Rexburg, Madison Co.; Rigby, Jefferson Co.; Malta and Oakley, Cassia Co.; Twin Falls and Shoshone Falls, Twin Falls Co.; McCammon, Bannock Co.; and Paris, Bear Lake Co.; (V. M. Tanner 1931). Delco, Cassia Co.; (W. W. Tanner 1940).

LIZARDS

Crotophytus collaris baileyi (Stejneger). The Western Collared Lizard

Published Records: Mouth of Bruneau River, Owyhee Co.; (Van Denburgh 1922). Below Melba, Snake River Canyon, Ada County; (Erwin 1928).

Remarks: In reporting this species, Mr. Erwin regards it as "not common," and adds that it is "generally found on large boulders even during the hottest days."

Crotophytus wislizenii (Baird & Girard). The Leopard Lizard

Published Records: Snake River near Fort Boise, (Cooper 1860). Plains across river from Glenns Ferry and mouth of Burneau River, Owhyee Co.; Blue Lakes to Shoshone Falls, Jerome Co.; Twin Falls and south side of Snake River near Salmon Falls, Twin Falls Co.; Cottonwood Creek, Cassia Co.; Plains north side of Snake River between upper Salmon Falls and Bliss and between Bliss and Snake River, Gooding Co.; Glenns Ferry and Mountain Home, Elmore Co.; Boise, Ada Co.; Weiser, Washington Co.; Fort Hall, Bingham Co.; (Van Denburgh 1922).

Remarks: Mr. Erwin refers to this species as "fairly common," in southwestern Idaho. In my collection are several specimens collected at Fort Hall, Bingham Co., by Dr. V. E. Jones in May 1936 and one specimen from Owyhee Co., collected in 1938.

Uta stansburiana stansburiana (Baird & Girard). Stansbury Lizard

Published Records: South side of Canyon between Shoshone Falls and Twin Falls, Twin Falls Co.; Blue Lake to Shoshone Falls, Jerome Co.; Plains and Snake River bottom near Bliss, Gooding Co., (Van Denburgh 1922). Seventy-three specimens of this species collected from the following localities, Swan Falls (Snake River), Snake River below Melba and Ten Mile Creek, 15 miles south of Boise, Ada Co.; Indian Cone, near Snake River and 4 miles south of Cleft, Elmore Co.; Sucker Creek near Oregon Line south of Homedale, Bruneau River Canyon 15 miles south of Bruneau, and Reynolds Creek west of Murphy, Owyhee Co.; were collected by Mr. R. P.

Erwin and sent to the Brigham Young University. In his report of southwestern Idaho he refers to this species as common in the rocky desert areas.

New Records: Near Shoshone Falls, Cassia Co.; Dr. D. E. Beck June 1928; near Wilder, Canyon Co., W. W. Tanner August 1940.

Remarks: This species is apparently common in southwestern Idaho. I found it to be numerous from Wilder, northwest along the Snake River to Adrian, Oregon, August 1940.

Sceloporus graciosus graciosus (Baird & Girard). The Sagebrush Swift

Published Records: Fort Hall, Bingham Co.; and from Salt Lake to Oregon (Cope 1871). Blackfoot, Bingham Co.; Big Lost River, Butte Co.; Lemhi Indian Agency, Lemhi Co.; (Stejneger 1891). Pocatello, Bannock Co.; Idaho Falls, Bonneville Co.; Plains near Conant, Cassia Co.; plains between Shoshone and Blue Lakes and Blue Lakes Canyon, Jerome Co.; Bliss and Plains between Bliss and Snake River, Gooding Co.; Plains across river from Glenns Ferry, Owyhee Co.; Boise, Ada Co.; Weiser, Washington Co.; (Van Denburgh 1922). Rexburg, Madisen Co.; (W. W. Tanner 1940).

New Records: Oakley, Cassia Co.; V. M. Tanner June 1928; Stone and Holbrook, Oneida Co., G. F. Knowlton.

Sceloporus occidentalis biseriatus (Hallowell). The Western Blue-bellied Lizard

Published Records: The sage brush plains between Shoshone and Blue Lakes, Blue Lakes Canyon, on Canyon Walls at Shoshone Falls north of ferry, Jerome Co.; and Boise, Ada Co.; (Van Denburgh 1922).

Remarks: Mr. R. P. Erwin lists this species for southwestern Idaho with the comment that they are "very common." I have seen specimens from Ada and Owyhee Counties.

Phrynosoma douglassii ornatissimum (Girard). The Short-Horned Horned Lizard

Published Records: "Found on the plains west of the Rocky Mountains, as far west as the Cascade Range. One was caught in September near the Snake River, Oregon territory." (Cooper 1860). Fort Hall, Bingham Co., (Cope 1871). Clearwater River 7 miles above Lewiston and at Lewiston, Nez Perce Co.; Boise, Ada Co.; Big Butte, and Aero, Butte Co.; Shoshone, Jerome Co.; Sage Brush plains near Conant, and Cottonwood Creek, Cassia Co.; Blackfoot, Bingham Co.; American Falls, Power Co.; and Pocatello, Bannock County, (Van Denburgh 1922).

Remarks: The exact range of this species is not known; it appears certain, however, to cover most of southern and central Idaho. Mr. Erwin comments as follows: "We have found this lizard only occasionally in sandy places in rock-strewn, semi-arid country."

In assigning *Phrynosoma douglassii ornatissimum* to Idaho, I realize that this is as yet quite an unsolved question. Few groups of reptiles are in such dire need of study as the short horned lizards. Probably the best summary of this group is that given by Dr. Van Denburgh in his "Reptiles of Western North America Vol. I, pp. 371-376. As it now stands one is not sure whether to refer to the Great Basin and Southern Idaho forms as *P. d. ornatissimum* or *P. d. ornatum* or if two distinct groups exist. Until more information is available I choose to use *P. d. ornatissimum* for the Idaho specimens.

Phyrnosoma platyrhinos Girard. The Desert Horned Lizard

Published Records: Mouth of Bruneau River, and plains across river from Glenns Ferry, Owhyee Co.; Lava Plains, Shoshone and Snake River and Sage plains between Shoshone and Blue Lakes, Jerome Co.; Plains between Bliss and Snake River, Gooding Co.; Cottonwood Creek, Cassia Co.; reported by Cope for Sandpoint, Bonner Co., (Van Denburgh 1922).

Remarks: I have specimens collected from near Bliss by Dr. V. E. Jones, and two specimens collected from Owyhee County. Mr. Irwin reports this species as "fairly common." "Found in sandy, gravelly places in semi-arid areas." Its complete range in Idaho is unknown.

Gerrhonatus coerveus principis (Baird & Girard). The Northern Alligator Lizard

Published Records: A few miles south of Sandpoint, Bonner Co., (Slipp 1940).

Cnemidophorus tessellatus tessellatus (Say). Desert Whiptail Lizard

Published Records: Between Shoshone Falls, Twin Falls and Upper Salmon Falls, Twin Falls Co.; Conant, Cassia Co.; Bliss, Gooding Co.; Glenns Ferry, Elmore Co.; Boise, Ada Co.; Payette, Payette Co.; (Van Denburgh 1922). Snake River Canyon southeast of Melba, and Swan Falls, Ada Co.; Given's Hot Springs in the Snake River Valley, Canyon Co.; Snake River across from Given's, 18 miles south of Bruneau, Bruneau River Canyon, South of Nampa, and south of Walter's ferry, Owyhee County (Burt 1931).

New Records: This species was numerous in the willows on both

sides of Snake River southwest of Wilder, Canyon and Owyhee Counties, August 17, 1940.

EUMECES SKILTONIANUS SKILTONIANUS (Baird & Girard). The Western Skink

PUBLISHED RECORDS: Boise, Ada Co.; and Fort Hall, Bingham County, (Van Denburgh 1922). Pocatello, Bannock Co.; Lewiston, Nez Perce Co., (Taylor 1935).

REMARKS: Mr. R. P. Erwin lists this species as "rare" in southwestern Idaho. Intensive collecting from Ada County north will undoubtedly extend the range of this species in Idaho.

SNAKES

CHARINA BOTTAE (Blainville). The Rubber-Snake

PUBLISHED RECORDS: Blue Lake and Hood's Valley, Kootenai Co.; Hope, Bonner Co.; and Fish Haven Creek, Bear Lake Co., (Van Denburgh 1922). Paris, Bear Lake Co., (V. M. Tanner 1933).

NEW RECORDS: Jarbridge Canyon, Owyhee Co., 1936, J. W. Asdale.

REMARKS: Mr. Erwin refers to this species as "fairly common" and as "usually found in moist shady places, and especially in rotten logs."

DIADOPHIS AMABILIS OCCIDENTALIS Blanchard. The Western Ringneck Snake

One specimen was collected five miles southwest of Horseshoe Bend, Boise County, by Mr. Joe Webster, November 1937, (Reported by Uhler 1940).

DIADOPHIS REGALIS REGALIS (Baird & Girard). The Thimble Snake

A specimen was collected in the mountains east of Preston, Franklin Co., by a student who later gave it to Dr. J. S. Stanford of the Utah State Agricultural College at Logan, Utah, (Reported by W. W. Tanner 1940).

COLUBER CONSTRICTOR MORMON (Baird & Girard). Blue Racer

PUBLISHED RECORDS: Big Butte, Butte Co., (Stejneger 1890), Coeur D'Alene, Kootenai Co.; Boise, Ada Co.; Atlanta, Elmore Co.; the mouth of the Bruneau River, Owyhee Co.; and Upper Salmon Falls, Gooding Co., (Van Denburgh 1922). Caldwell, Canyon Co., (W. W. Tanner 1940).

NEW RECORDS: Clifton, Franklin Co., Douglas Merrill 1933. Mt. Idaho, Idaho Co., W. W. Tanner 1940.

Coluber taeniatus taeniatus (Hallowell). The Western Striped Racer

Published Records: Bliss, Gooding County, and Boise, Ada County, Van Denburgh 1922).

Remarks: Mr. R. P. Erwin reports this species as "common" in southwestern Idaho. I have seen several of the specimens collected by Mr. Erwin from Ada and Owyhee Counties.

Pituophis catenifer deserticola Stejneger. The Desert Gopher Snake

Published Records: Fort Boise, Canyon Co., (Cooper 1860); Big Butte and Arco, Butte Co., (Stejneger 1891). Boise, Ada Co.; Blue Lakes, Twin Falls Co.; Indian Valley, Adams Co.; Bear Lake Co., (Van Denburgh 1922); Colson Creek, Salmon River, Lemhi Co.; Swan Lake, and Pocatello, Bannock Co., (W. W. Tanner 1940).

New Records: Two miles west of Boise, Ada Co., R. P. Erwin; Fairfield, Camas Co., Cleo Pond 1939; Jump Creek, Owyhee Co.; and a specimen from Moores Creek.

Rhinocheilus lecontei Baird & Girard. The Long-nosed Snake

One specimen was reported by Dr. John Van Denburgh for Glenns Ferry, Elmore Co., Idaho. This area is dry and provides an environment very similar to that of southern and western Utah where several specimens of this snake have been collected. Careful collecting will surely produce more specimens from Idaho.

Sonora miniata miniata Stickel

Published Records: Snake River Canyon near Guffey, Ada County, (Erwin 1925-28).

Remarks: One specimen in the State Historical Society of Idaho (No. 7) must be referred to this species. This specimen was collected by Mr. R. P. Erwin on the north rim of the Snake River near Guffey, Ada Co., April 1924. Other specimens were collected at this same time and deposited in other collections.

The scale counts and measurements on this specimen are as follows: Scale rows 15–15–14, ventrals 174, caudals 49, upper labials 7–7, lower labials 6–6, oculars 1–2, loreal 1–1, temporals 1–2, anal divided, total length 270, tail length 51, the color was uniform brown.

Sonora semianulata semianulata Baird & Girard. Bicolor Ground Snake

Published Records: Northern bank of the Snake River, Ada County and Bruneau River, Owyhee County, (Erwin 1925-28).

Remarks: Two specimens collected by Mr. Richard P. Erwin

have been studied by the writer. One specimen in the State Historical Society of Idaho (No. 4) was collected along with several other specimens on the north rim of the Snake River near Guffey, Ada County, April 1924. A second specimen in the reptile collection of the College of Idaho (No. 645) was collected at Hot Springs on the Bruneau River, Owyhee County, Idaho. Dr. Smith at the College of Idaho also reported that a specimen had been taken along the Snake River south of Caldwell, Canyon County, Idaho.

HYPSIGLENA OCHRORHYNCHUS OCHRORHYNCHUS. The Night Snake

Three specimens of this species were collected by Mr. Erwin, at Lucky Peak 7 miles east of Boise, June 29, 1919; Swan Falls, Snake River, September 17, 1824; and Ten Mile Creek Canyon, 15 miles south of Boise, Ada County, Idaho, (Erwin 1925-28).

THAMNOPHIS ORDINOIDES VAGRANS Baird & Girard

PUBLISHED RECORDS: Fort Boise(Cooper 1860) between Copenhagen, Utah and Fort Hall, Idaho, (Cope 1871) ; Salmon River Mountains, Lemhi Co.; Challis Valley, Custer Co.; Birch Creek, Clark Co.; and Trail Creek, Idaho, (Stejneger 1891). Sand Point and Hope, Bonner Co.; Kootenai County; Wardner, Shoshone Co.; Lewiston, Nez Perce Co.; Weiser, Washington Co.; Payette Lakes, Valley Co.; Boise, Ada Co.; Malad River Canyon, Camas, Kelchum, and Guyer Hot Springs, Blaine Co.; Arco, Butte Co.; Shoshone Falls, Jerome Co.; Salmon Falls, Twin Falls Co.; Albion and Cottonwood Creek, Cassia Co.; Fort Hall, Bingham Co.; Malad, Oneida Co.; and Bear Lake, Bear Lake Co.; Idaho (Van Denburgh 1922). Mr. Henry S. Fitch in his recent paper on the *Ordinoides* group lists specimens from the following localities: Troy, Latah Co.; Castle Rock Ranger Station, south fork of Clear Water River, Idaho Co.; ½ mile east of Black Lake, 1 mile north of Bear Ranger Station Mount Smith, Adams Co.; Heath, Cuddy Mountains, Crane Creek, 15 miles east of Midvale, Washington Co.; Island Park, Snake River near Yellowstone National Park, inlet to Henry's Lake, Sheridan Creek, Fremont Co.; Idaho City, Boise Co.; Pass Creek, Butte Co.; 3 miles southwest of Victor, Teton Co.; Petit Lake, Alturas Lake, Blaine Co.; 7 miles west of Idaho Falls, Bonneville Co.; 2 miles southwest of Aberdeen, Bingham Co.; Homedale, Snake River north of Murphy, Reynolds Creek 12 miles south of Snake River, Castle Creek 8 miles south of Oreana, and Indian Creek 2 miles south of Riddle, Owyhee Co.; Little Wood River, Lincoln County; Elba, Cassia Co.; (Fitch 1940) ; Lewston, Ketchum, Fort Hall, Idaho, (Ruthven 1908).

NEW RECORDS: Jefferson Co., George Marler July 1926; Madison

County, George Marler June 1926; Oakley, Cassia Co., V. M. Tanner 1928; Delco, Cassia Co., W. W. Tanner July 1939; Warm River Crossing, Fremont County, George Marler 1926; Clifton, Franklin Co., Douglas Merrill July 1933; Shoshone Falls, Jerome Co.; V. M. Tanner & D. E. Beck, June 1928; Fairfield, Camas Co., Cleo Pond, July 1938; Pocatello, V. E. Jones, Bannock Co.; Whitebird, Idaho Co., W. W. Tanner, August 1940; Belvidere, Valley Co., W. W. Tanner August 1940.

Remarks: Many specimens collected by Mr. R. P. Erwin from southwestern Idaho are in the State Museum at Boise, Idaho. In commenting on this species Mr. Erwin refers to it as "very common."

Thamnophis sirtalis parietalis (Say). The Prairie Garter Snake

Published Records: Bear Lake, Bear Lake Co.; Weiser, Washington Co.; Boise, Ada Co.; Payette Lake, Boise Co.; and Blue Lake, Jerome Co., (Van Denburgh 1922).

New Records: Dagget Creek, Boise Co., R. P. Erwin Aug. 1925; Caldwell, Canyon Co., (no date or collector listed); Clark Co., George Marler Sept. 1926; Clifton, Franklin Co., Douglas Merrill, 1933; Delco, Cassia Co., W. W. Tanner, July 1939.

Remarks: Mr. R. P. Erwin lists *Sirtalis concinnus* for southwestern Idaho. This was undoubtedly a misidentification, since *concinnus* is limited to the Cascade area. Specimens examined from the Ada-Canyon Co. areas appear more like the *parietalis* group both in color and scale counts, than to those of Northern Idaho and Washington. Unfortunately too few specimens are available to make a careful separation at this time.

Thamnophis sirtalis tetrataenia (Cope)

Two specimens collected at a small stream just west of Coeur D'Alene Lake, Kootenai, Co., are referred to this subspecies. The scale counts are identical with specimens from southern Idaho but the color pattern is much darker. In color they are more like the specimens of Yakima, Washington. Here again too few specimens are at hand to state with certainty to which subspecies they should be referred. Because of their close resemblance to the Washington specimens it seems more likely that they belong to this subspecies.

Crotalus viridis lutosus (Klauber). The Great Basin Rattlesnake

Published Records: Snake River, (Cooper 1860); Blue Lake Canyon, Jerome Co.; Twin Falls, Twin Falls Co.; Big Butte and Little Lost River, Butte Co., Idaho, (Van Denburgh 1922). Black Creek Canyon 15 miles south of Boise, Ada County, (Erwin 1925). Melba,

Canyon Co.; Regena and Cleft, Elmore Co.; Madison Co.; and Teton Co.; (Klauber 1930). Fairfield, Camas Co., (W. W. Tanner 1940).

New Records: Clifton, Franklin Co.; Douglas Merrill July 1933; near Bannock, Power County, W. W. Tanner 1939; Pocatello, Victor E. Jones, May 1936.

Remarks: Mr. L. M. Klauber informs me that "*lutosus* occupies the southern part of the state from Fremont and Clark Counties on the east to Southern Valley County and Payette County on the west, and from these south, although there is a section in the central area where they apparently do not go quite so far north as a straight line drawn between the counties mentioned."

Crotalus viridis viridis (Rafinesque). The Prairie Rattlesnake

Published Records: Lemhi Valley near Indian Agency (Stejneger 1891).

Remarks: Mr. L. M. Klauber reports the range for this species to be, "along the Salmon and Lemhi Rivers from Horse Creek east and southeast at least to the town of Lemhi."

Crotalus viridis oreganus Holbrook. The Pacific Rattlesnake

This subspecies is reported by Mr. L. M. Klauber to occur "along the western edge of Idaho from Weiser and Council on the south to Riverdale, Kootenai Co. on the north, and to penetrate eastward up the river valleys, especially up the Salmon and Clear Water Rivers."

SUMMARY

1. In this report 12 species of amphibia and 26 species of Reptiles are listed for Idaho.

2. Notes on the general distribution within Idaho and published records available to the writer are listed.

3. Many of the species are based upon comparatively few records, and several by only one specimen. Careful collecting will surely produce interesting distributional records for Idaho.

Gull Banding Notes at Utah Lake

The California gull, *Larus Californicus* Lawrence was first banded at Rock Island in Utah Lake on June 14, 1940. The banding party consisted of Reed Biddulph, Dr. W. B. Hales, Dr. D. E. Beck, James Bee, Cluff Hopla, Blair Carlson, Dwight Taylor, Vasco Jordan Tanner, and Dr. Vasco M. Tanner. Banding began at 7:00 A. M. and by 11:50 A. M. 1,000 gulls had been banded with three bands; a yellow band over a red one on the right leg and an aluminum Biological Survey band on the left leg. The survey bands were numbered 680,001 to 681,000.

This banding was undertaken for the purpose of ascertaining something about the migratory movements of the gulls. We are especially anxious to learn if the birds return to this island and if they select the territory on the island in which they were reared.

At this writing we have received reports from the Fish and Wildlife Service and Mrs. Grace Sargent, chairman of Pacific Gull Project on twenty-seven of the banded gulls. One no. 680,997 was found dead by W. R. Creer on July 1, 1940 at Spanish Fork, Utah; while seventeen were found dead by the writer and Dr. Beck on Rock Island on July 16, 1940. Apparently many of these were injured by the adult gulls at the time of banding. On July 29, 1940 one was found sick and unable to fly by Miss Della Barney at Spanish Fork; one was caugh near Fallen, Nevada on July 30 by Edwin Harrigan; one was found dead by Elizabeth Aureiter at Wecoma Beach, near Ocean Lake, Oregon on August 3; one was found injured and killed by George Hummer at Santa Cruz, California, on August 4. Buster Hammond of Newport, Oregon found one dead on August 24; and Mr. V. T. Wilson on August 26 found one dead on the Bear River Refuge. Two different gulls were sighted at La Jolla, California by Mr. and Mrs. A. E. Hutchinson; one on February 2, 1941 and the other one on February 24. Mr. P. Stoddard saw one on February 8, on the University of California Campus at Los Angeles.

For the second year 1,000 gulls were banded on Rock Island on June 17, 1941. The members of the party this year were Ted Johnson, Harry Chandler, E. C. Draper, Dr. D. E. Beck, J. C. Bement, Jordan Tanner, Carmela Tanner, and Dr. Vasco M. Tanner. Three bands a red, then aluminum survey band and finally a yellow one were put on the left leg. The aluminum bands were numbered 649,001 to 650,000.

After banding we estimated that one out of every fifteen or sixteen of the young gulls was banded. There are about ten to twelve thousand nests on the island this year and barring fatality, due to cold stormy weather, the infertility of the eggs, and starvation, there will be at least fifteen to sixteen thousand young gulls reach flight maturity. Dr. Beck has made a rather careful study of the gulls since they came to the island last spring and we believe there are at least twenty-four to twenty-five thousand adult gulls in the colony.

We are surprised at being unable to find any of the 1940 banded gulls in the colony. Considerable care and time has been spent in observing the gulls on the island and in the fields this spring, but as yet we have failed to find any banded birds.—V.M.T.

NEW SPECIES OF COLEOPTERA FROM UTAH[1]

(Omophronidae and Dytiscidae)

HARRY P. CHANDLER

While collecting on the Escalante River in the Colorado River region a large series of light colored Omophronidae were obtained. These proved uniformly different from our more common southern Utah form in the Genus *Homophron*. When the latter was checked it was found not to agree with any of the descriptions of this genus. Both forms are closely related to *illustre* and various subspecies of *americanum*, but have the maculations more restricted.

KEY TO THE UTAH SPECIES OF OMOPHRONIDAE

1. Elytra 15 striate.....*Homophron* 2
   Elytra 14 striate.....*Prosecon* 4

2. Pale areas of the dorsal surface predominating, no romboidal maculation on the suture of the elytra near the apex 3

   Dark areas of the dorsal surface about equal to the pale areas, elytra shining, with bright dark metallic green luster, suture usually with a romboidal maculation near the apex.....*illustre* Csy.

3. Tips of mandibles short and stubby (Fig. 7), ground color testaceous, maculations black, only faintly metallic, ambulatorial setae on the fifth abdominal sternite .....*tanneri* sp. nov.

   Tips of mandibles long and pointed (Fig. 6), ground color cream, maculations more confined, bright metallic green in color, rarely with ambulatorial setae on fifth abdominal sternite.....*tanneri proximum* subsp. nov.

4. Dark areas predominant, maculations black or with very faint metallic color, striae deep and rather coarsely and deeply punctured.....*obliteratum utense* Csy.

   General color of upper surface pale, the dark markings small without metallic color, or color very faint, luster dull .....*gilae pallidum* Csy.

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(1) Contribution No. 93 from the Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

HOMOPHRON TANNERI Chandler, sp. nov.

FEMALE: Length 5.8–7.0 mm. Width 3.6–4.2 mm. General color, ground color of the upper surface testaceous, maculations black with faint metallic green tint, becoming stronger anteriorly, pale area predominating but less so than in Fig. 8, under surface dark piceous red. Head with angular pale smooth frontal area, metallic green basal area with punctures and sculpturing, the posterior side of the clypeus is somewhat paraboloid, the lateral edges being darkened so as to make the curve seem more even. Mandibles (Fig. 7) are short and stubby as in *H. americanum,* dorsal ridge evenly curved to join the lateral edge of the mandible. Eyes black, and prominent; antenna slender, flavo testaceous, basal four joints glaberous, distal joints pubescent. Pronotum predominantly dark, faint metallic green with pale lateral edges; posterior and anterior arms of pale extend inward becoming quite dark in color. The lateral edge finely emarginate. Elytra 15 striate, striae finely impressed, intervals moderately convex, flatly so behind the posterior maculations. Body beneath, prosternum marginate along the sides of the posterior process. Metasternum marginate along the anterior and lateral edges of the disk. Ambulatorial setae on segments 4, 5, and 6 of the abdomen.

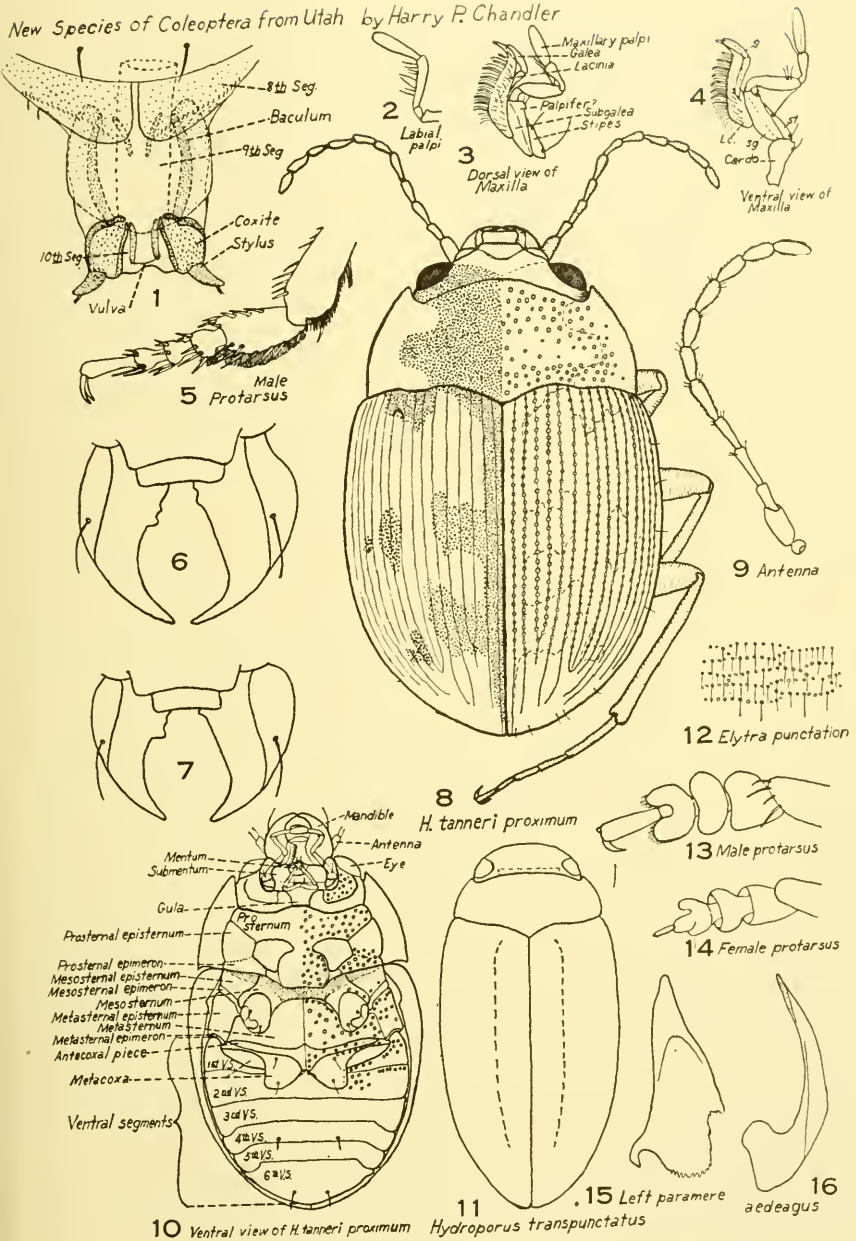
MALE: Length 5.2–5.9 mm. Width 3.3–3.6 mm. Prothoracic tarsi with the first segments enlarged and widened having a brush underneath, second joint with small brush.

TYPE LOCALITY: Moab, San Juan Co., Utah.

Besides the female holotype and male allotype which are from Moab, Utah, there are also 35 females and 20 males from Moab, Utah, collected by the following: James Kartchner, Anson Call Jr., Irwin Rasmussen and Dr. Vasco M. Tanner. Other localities represented are La Sal, Utah (Anson Call); Blanding, Utah (Vasco M. Tanner); Marysvale, Utah (Vasco M. Tanner); and Vernal, Utah (Rowland Rigby). The holotype and allotype along with about 50 paratypes are in the Brigham Young University Collection. Paratypes will be deposited at the California Academy of Sciences and the U. S. National Museum.

HABITAT: This species is found in a sandstone desert area along the banks of rivers on the sandy banks.

REMARK: This species is related to *Homophron illustre,* and *H. americanum texanum* but is less broadly oval and smaller, especially in the male. The maculations are more restricted and the upper surface less glassy without the prominent metallic dark green luster.



FIGURES 1 TO 16

HOMOPHRON TANNERI PROXIMUM Chandler, subsp. nov.

FEMALE: (Fig. 8 & 10). Length 6.1–6.5 mm. Width 3.7–4 mm. General color, base color of the upper surface is cream with bright metallic green maculations, pale area predominating, under surface reddish brown. Head with angular pale impunctate frontal area, metallis green basal area with punctures and sculpturing; antenna (Fig. 9); mandibles large with long sharp tips (Fig. 6), the dorsal ridge sharply bent on fusing with the lateral edge; mouth parts (Fig. 2, 3, & 4). Pronotum predominantly bright metallic green with pale lateral edges finely marginate. Elytra 15 striate, striae weakly impressed, faintly extending beyond the posterior dark spot; intervals flatly convex; punctures small and deep, not impressed behind the posterior dark spot, except rarely very faintly. Ambulatorial setae (Fig. 10) on segments 4 and 6 of the abdomen, rarely on the fifth. Genitalia Fig. 1.

MALE: Length 5.7–6.1 mm. Width 3.3–3.7 mm. Prothoracic tarsi with basal 2 joints enlarged (Fig. 5).

TYPE LOCALITY: Box Canyon near the junction of Calf Creek and the Escalante River in Garfield Co., Utah, (the first right hand canyon on the Escalante River above Calf Creek).

HABITAT: A large number of this subspecies were taken at the head of a box canyon near an isolated pool, which was about 30 feet in diameter with a small stream running out of it for about 100 feet. They were quite numerous and were found hiding in cracks and under the leaves rather than burrowing holes in the sand. This pool is about 2 miles from the Escalante River and has no water connections except possibly for a brief period during the spring runoff or thunder showers. It appears that the species may have developed around these isolated shaded still water pools at the head of the box canyons of the vicinity. On the Escalante River proper the form seems to be very variable, approaching *H. tanneri* with various combinations of the characters of each type. The individual characters do not seem to intergrade. Some specimens, seemingly hybrids, are larger and more broadly oval than either *tanneri* or *tanneri proximum*.

The holotype and allotype will be placed in the Brigham Young University collection. Besides the holotype and allotype there are 30 paratypes all from the type locality.

FAMILY DYTISCIDAE

HYDROPORUS TRANSPUNCTATUS Chandler, sp. nov.

Length, male 5 mm.; female 4.8 mm. Width, male 2.4 mm.; female 2.35 mm. General form evenly elyptical (Fig. 11); integuments shining alutaceous, elytra of male less alutaceous. Ventral side almost entirely black. Head black except for a sharply defined transverse rufous patch on the vertex, underside black. Antennae and mouth parts piceous, a little less so on the under side and at the base of each segment. Pronotum alutaceous with disk finely and sparcely punctured, margins more closely and coarsely punctured especially in the male, lateral edges finely but distinctly margined. Elytra a clear piceous brown; the suture black; the inflexed edge, which covers the black side pieces of the ventral segments, appearing black; a faint longitudinal row of coarser punctures about a third of the width of the elytra from the suture. Punctures of the elytra small arranged in transversely elongate reticulate rows, (Fig. 12), the distance between the rows about 2–2½ times the distance between the punctures in the same row. Pubescence fine, about twice the distance between the rows of punctures in length. Prosternum and epipleura black. Metasternum and coxal plates finely and sparsely punctured, punctures coarser at sides, less so in female. Ventral segments faintly and sparsely punctured except the sides of the first and second segments of the male which are coarsely and closely punctured as is also the posterior half of the last segment; the female with obscure rufous spots at sides. Legs black except the inner sides of the tibia tarsus and trochanters which may be obscurely rufous. Pro- (Fig. 13) and mesotarsi of male broadly expanded; the second segment of the protarsus slightly wider than the first segment which is slightly wider than the third, the second segment twice as wide as long, the third with the lobes as long as the basal part, the claws large the anterior one shorter, stouter and more curved at tip. Male mesotarsus with joints 1 to 3 slightly decreasing in width, general form similar to protarsi, claws small, a little larger than those of the hind tarsi.

Female protarsi (Fig. 14) resembling somewhat the male in general form but much reduced, the fourth segment completely reduced, the fifth united with the bilobed third, so that the third appears trilobed, the posterior lobe somewhat reduced. Only one claw is developed, it is stout, small and evenly curved. Female mesotarsus not widely expanded. Male genitalia (Fig. 15 and 16).

TYPE LOCALITY: The author collected both the male Holotype and

the female Allotype on Aug. 1, 1938 at Salamander Lake (pond), Mt. Timpanogos, Ut. Co., Utah.

The holotype is labeled "Aspen Grove Ut., No. A534, 8/1/38." It will be deposited in the collection at the Brigham Young University. The allotype is labeled "Aspen Grove Ut., No. A535, 8/1/38"; it will remain in the author's personal collection.

The arrangement of the punctures of the elytra in lines is more evident if a source of light from above is used. The punctures are quite small but are evident if a good magnification is obtained. This species would likely be run to *axillaris* in Fall's key. It may easily be separated by the greater amount of piceousness of the under surface and mouthparts, and the arrangement of the punctures of the elytra. The modification of the female protarsus is quite unique if it proves constant.

Painted Lady Butterfly in Migration

Again we wish to record the migratory movements of the Painted Lady Butterfly, *Vanessa cardui* L. While on a collection and study trip through southwestern Utah and Clark County, Nevada, the writer encountered large numbers of this species at Kanarraville, Iron County, Utah, on April 27, 1941. They were flying northward along highway 91. I continued to pass through hundreds of specimens flying from three to ten feet high, down to Anderson's Ranch in Washington County, Utah. From here to Hurricane and St. George there was about the normal number of specimens of this species, flitting about in the fields and along the highway. On April 30 I again encountered this species in migration northward over the Mormon Mesa in Nevada. This same species was common around Boulder City and Hemenway Wash and on Horseshoe Island in Mead Lake on May 1, 2, and 3. Mr. Russell K. Grater, Zion Park Naturalist and Dr. A. M. Woodbury of the University of Utah, reported to the writer a heavy migration northward in Sevier and Sanpete valleys of central Utah from April 30 to May 5, 1941. Several specimens were collected at these various localities which makes certain the identification of this species.—V. M. T.

THREE NEW MAMMALS (MICROTUS AND OCHOTONA) FROM UTAH[1]

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and

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Recognition, several years ago, of the distinctive characters of specimens of *Microtus montanus* from central Utah led to the saving of additional specimens for the collections of the Zoology Department of Brigham Young University. Study and comparison of these specimens with topotypes and other pertinent materials in the Museum of Vertebrate Zoology of the University of California reveals the existence of two hitherto unnamed geographic races of meadow mice. Also, specimens of the pika from south-central Utah are found to belong to a previously unrecognized race. Descriptions and names for these three new subspecies are offered below:

MICROTUS MONTANUS AMOSUS Hall and Hayward, subsp. nov.

TYPE: Female, adult, skin and skull; no. 95272, Mus. Vert. Zool.; Torrey, Wayne County, Utah; June 18, 1938; collected by James W. Bee; original no. 705.

RANGE: Fremont River drainage in south-central Utah.

DIAGNOSIS: Size large; tail long (25 to 27 per cent of total length); color reddish; skull with short palate and short nasals; braincase wide across mastoidal region; auditory bullae large.

COMPARISONS: Individuals of this race are larger than those of *nanus, nexus, fusus* or *micropus* and apparently are larger even than *arizonensis.* The size is about as in *fucosus* and *rivularis.* The reddish color of the upper parts distinguishes *amosus* from *nanus, micropus, fucosus* and in lesser degree from *nexus,* but resembles that of *fusus, arizonensis* and *rivularis.* From *rivularis,* seemingly the closest relative of *amosus,* it is distinguished by smaller skull, with, nevertheless, much larger auditory bullae. Individuals of *arizonensis,* which is the second closest relative of *amosus,* are smaller bodied.

(1) Contribution from the Museum of Vertebrate Zoology, University of California, and the Department of Zoology and Entomology, Brigham Young University.

Remarks: Specimens, not at this writing available for examination, from Jensen, Uintah County, Utah, were previously commented upon (Proc. Biol. Soc. Washington, vol. 51, p. 132) as intermediate in some respects between the small reddish race *fusus* from Colorado and the larger, more blackish race *micropus* from Nevada. These specimens from Jensen possess several characters which give basis for thinking that when the geographic ranges of the subspecies of *Microtus montanus* in Utah are more thoroughly worked out, the race *amosus* will be found to have an extensive range in the Colorado River drainage in that State.

Measurements: Average and extreme measurements in millimeters of 3 adult males from Steep Creek, Garfield County, and 5 adult females from Torrey, Wayne County, are: Total length, ♂, 174 (170–179), ♀, 180 (175–185); length of tail, 44 (41.5–46), 48 (40–54); length of hind foot, 20.2 (20.0–20.5), 20.7 (20.0–21.5); weight in grams, 62.0 (57–67), 67.0 (58–76); condylobasal length, 29.2 (28.9–29.5), 29.9 (29.0–30.3); occipitonasal length, 27.8 (27.4–28.1), 28.4 (27.4–29.4); nasal length, 8.4 (8.2–8.5), 8.6 (8.3–8.9); zygomatic breadth, 16.9 (16.5–17.3), 17.3 (17.0–17.6); interorbital breadth, 3.6 (3.6–3.6), 3.7 (3.5–3.9); mastoidal breadth, 13.8 (13.2–14.6), 13.6 (13.3–13.9); alveolar length of upper molar series, 7.1 (7.0–7.2), 7.4 (7.1–7.7); breadth of rostrum measured between ventral margins of infraorbital canals, 5.3 (5.2–5.3), 5.5 (5.4–5.7); palatilar length, 14.9 (14.5–15.2),15.6 (15.0–16.0); width of tympanic bulla between anterodorsal face of external auditory meatus and posterior opening of stapedial canal, 6.3 (6.2–6.3), 6.4 (6.2–6.5).

Specimens Examined: Total number, 25, as follows: WAYNE CO.: Torrey, 6,500 ft., 15. GARFIELD CO.: Steep Creek, 8,500 ft., 10. With the exception of the type, all specimens are in the collection of the Department of Zoology, Brigham Young University.

Microtus montanus nexus Hall and Hayward, subsp. nov.

Type: Female, adult, skin and skull; no. 95271, Mus. Vert. Zool.; West Canyon, Oquirrh Range, Utah County, Utah; August 3, 1939; collected by James W. Bee; original no. 19-8-3-39.

Range: Valleys and mountains of central Utah from Ogden south to Fish Lake Plateau; limits of range undetermined.

Diagnosis: Size medium; tail relatively long (averaging 28 per cent of total length); upper parts with some reddish and some blackish; skull small; palate and nasals short; braincase relatively narrow across mastoidal region; tympanic bullae large.

Comparisons and Remarks: Individuals of this race are small and in that respect approach *nanus* and *fusus*. *M. m. nexus* is less reddish and more blackish than *fusus*, blacker and less grayish than *nanus* and less blackish than the larger *micropus*. Although this subspecies is smaller than *micropus*, the auditory bullae are more inflated and actually are larger. The shorter palate, relatively shorter nasals, and relatively narrower braincase, as measured across the mastoidal processes, are other features differentiating *nexus* from *micropus*. The large bullae is a feature found also in *amosus* but it and *rivularis* can be differentiated readily from *nexus* by larger size.

The specimens from Fish Lake come from within the Colorado River drainage and therefore might be expected to be referable to *amosus*. Nevertheless they have more of the characters of *nexus* although they are not typical of that race.

Measurements: Measurements of 3 adults, ♂ no. 1728, ♀ no. 1730, and the type are: Total length, 172, 168, 155; length of tail, 42, 46, 41; length of hind foot, 21, 20.3, 20; weight in grams, 57, 70, 50; condylobasal length, 27.8, 27.5, 27.2; occipitonasal length, 26.5, 26.2, 26.2; nasal length, 8.0, 7.5, 7.3; zygomatic breadth, 16.0, 15.9, 15.6; interorbital breadth, 3.7, 3.6, 3.6; mastoidal breadth, 12.3, 12.3, 12.0; alveolar length of upper molar series, 6.4, 6.7, 6.5; breadth of rostrum measured between ventral margins of infraorbital canals, 5.2, 5.3, 5.0; palatilar length, 14.3, 14.4, 14.2; width of tympanic bulla between anterodorsal face of external auditory meatus and posterior opening of stapedial canal, 5.9, 6.4, 6.3.

Specimens Examined: Total number, 16, all from Utah, as follows: WEBER CO.: Ogden, 4293 ft., 3 (M.V.Z.); UTAH CO.: West Canyon, Oquirrh Range, 8 (7 in B.Y.U.), Provo, 4510 ft., 1 (M.V.Z.); SEVIER CO.: 10 mi. N. Fish Lake, Fish Lake Mts., 10,000 ft., 4 (M.V.Z.).

Ochotona princeps utahensis Hall and Hayward, subsp. nov.

Type: Male, adult, skin and skull; no. 95273, Mus. Vert. Zool.; 2 miles west of Deer Lake, Garfield County, Utah; June 25, 1938; collected by George Stanton Cannon; original no. 73.

Range: Known only from the type locality.

Diagnosis: Size large; hind foot of medium length; color dark grayish above; anteroposterior extent of palatal bridge equal to or more than transverse width of crown of last upper molar; interpterygoid space only slightly spatulate or parallel sided; tympanic bullae large; nasals broad posteriorly.

Comparisons: Among named kinds of pikas this subspecies most closely resembles *Ochotona princeps saxatilis* from the Rocky Mountains of Colorado in cranial characters. The tympanic bullae are larger in *utahensis* and this is the only distinguishing feature noted between skulls of the two. The hind foot of *utahensis,* if we may rely on collectors' measurements, is shorter and it is easily recognizable by the grayer color. The upper parts (June-taken specimens) are dark gray and lack the buffy or cinnamon color of *saxatilis* in comparable pelage; the underparts are darker cinnamon on the chest.

From *O. p. cinnamomea* and *O. p. fuscipes* which occur nearby to the westward, *utahensis* differs in larger size, grayer (less cinnamon) color, wider (anteroposteriorly) palatal bridge, and more nearly straight sides on the incisive foramina. The tympanic bullae of *utahensis* are smaller than in *fuscipes* and larger than in *cinnamomea.*

Remarks: Specimen labels bear the notation "Private Lake, SE Aquarius Plateau." We have not found this name on any map. The place where the specimens were taken is 2 miles west of Deer Lake, shown on the United States Forest Service map of Powell National Forest. Neither has a land survey been located for the area in question but it is judged that the locality lies in Sec. 9, R. 5E, T. 32S, Salt Lake Meridian.

Measurements: Average and extreme measurements of 5 individuals (3 ♂♂ and 2 ♀♀) from the type locality are: Total length, 191 (180-200); length of hind foot, 29.2 (28-30); occipitonasal length, 45.5 (42.8-47.4); zygomatic breadth, 22.1 (21.5-23.1); breadth of braincase, 18.5 (18.0-18.9); postorbital breadth, 14.6 (14.4-14.8); interorbital breadth, 5.4 (5.0-5.7); width of palatal bridge, 2.4 (2.1-2.8); length of nasals, 15.3 (14.8-16.3); alveolar length of upper toothrow, 9.1 (8.8-9.5).

Specimens Examined: Five from the type locality, four of which are deposited in the vertebrate collection at Brigham Young University.

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SOME OBSERVATIONS ON AMPHIBIA AT AND NEAR LAS VEGAS, NEW MEXICO

ARTHUR N. BRAGG(1)

The summer of 1940 (June 6 to August 25) afforded opportunity for the study of amphibians and reptiles in and about Las Vegas, San Miguel County, New Mexico. Field trips were taken almost daily; pools, ponds, and streams investigated at every opportunity, for the presence of tadpoles; and several breeding congresses of Amphibia observed. Representative collections of the herpetological fauna were made, tadpoles of several species of Anura were reared and studied in the laboratory, and copeous notes taken concerning ecological relations and habitats. Specimens have been deposited in the University of Oklahoma Museum of Zoology.

Las Vegas is located in the Valley of Gallinas Creek, a tributary of the Pecos River, in the short-grass plains. To the north and west, however, the elevation increases rapidly to the Aspen Zone of the Sangre de Christo Mountains within twenty miles up the Gallinas Valley. The elevation at Las Vegas is approximately 6,400 feet; at the edge of the Transition Zone, seven miles northwest of the city, it is 6,767 feet; and the Aspen Zone occurs at about 8,000 feet. The greater part of the rainfall occurs in July and August (mean over a period of seventy years, just over three inches for each of these months). From late June on through the summer, afternoon and evening showers are frequent, a circumstance which makes the dry hills and mesas of the region suitable habitats for some of the nocturnal, terrestrial Amphibia. Mean temperatures for June, July, and August are given by the U. S. Weather Bureau as 68.6, 67.1, and 60.7° F., respectively. It is a region of warm days and cool nights during the summer.

(1) Contribution from the Department of Zoology, University of Oklahoma, No. 231.

Possible breeding sites for Amphibia in this region include (1) permanent streams (principally the Gallinas and its tributary, the Arroyo de Pecos, the former passing through the center of the city, the latter skirting Las Vegas on the East); (2) irrigation ditches, of which one large one and many small ones occur; (3) ponds, formed by dams across streams, holding water for irrigation; (4) cattle-tanks in short-grass pastures; (5) temporary pools and ditches; (6) seepage pools from irrigation ditches, especially on the sides of mesas; (7) ponds and pools formed in shallow sandstone quarries on the hillsides just south of Romeroville, some seven miles south of Las Vegas; (8) beaver ponds in the Aspen Zone of the mountains, especially in the upper reaches of the Gallinas Valley; and (9) Alpine pools, formed by showers and melting snow, in the higher altitudes to the north. In most of these, the water is muddy with suspensions of a gray clay, some of which appears to be in a colloidal condition. In the beaver ponds, in very few of the temporary pools, and in seepage pools, the water may be temporarily or permanently clear. In the Alpine pools and beaver ponds, the water is always clear. In the lower reaches of the streams and in the pools formed by them here, turbidity depends essentially upon the violence of the local or mountain rains, since after heavy rainfall the runoff from the steep, sparsely vegetated slopes is very fast.

AMPHIBIA OBSERVED

(1) **Ambystoma tigrinum mavortium** (Baird). One adult was collected from wet pavement adjacent to a muddy temporary pond, one mile north of Las Vegas at night in June; another was taken in the basement of a house in Las Vegas in July. Larvae were numerous in muddy temporary pools of large extent in and near Las Vegas in June and July and in clear quarry-pools most of the summer. They were also found in numbers in alpine pools near the snow-line at about 11,000 feet elevation near the Taos County line, some forty miles north of Las Vegas. Those in the quarry-pools were of various sizes but those in the temporary and alpine pools were small and individuals varied but little in length. It seems probable that some specimens in this region are paedogenic, but the collection of adults proves that others are not.

(2) **Bufo woodhousii woodhousii** (Girard). The Rocky Mountain toad is almost certainly the only Bufo in the region. At least, under conditions of moisture and temperature known to be the most favorable for other species in Oklahoma (Bragg, 1940, 1940a, 1940b) none were found even with thorough search. Neither were tadpoles

of other species present at any time during the summer in any of the waters of the region.

B. w. woodhousii is very abundant all about Las Vegas. They were especially prevalent in the valley of the Gallinas at 6,767 feet elevation and below and in the valley of the Arroyo de Pecos within the city limits; but they also occurred high on the short-grass mesas and on the wooded mountain sides both at Montezuma and in Taos County to the north. Considering their prevalence in such situations in Oklahoma (Bragg, 1940a), it is interesting that none were ever found under street-lights at Las Vegas although actively searched for at several times, when they were known to be out. Since there was a relative scarcity of insects frequenting lights here as compared with Oklahoma, it seems proabbly that whenever these toads are attracted to streetlights, it is the prevalence of food rather than the presence of the lights *per se* which attracts them. These toads also feed abundantly among the pines on the steep hillsides at Montezuma (in the edge of the Transition Zone). Since few of them were found here before late June, but were found almost every night thereafter when looked for, it seems probable that the frequent afternoon showers at this season provided sufficient moisture on the otherwise dry hills.

It is probably well to note that specimens were brought to me from Taos County and from the valley of the Rio Grande near Chimayo, Rio Arriba County, the latter collected by Ezequiel Sandoval, one of my students.

The breeding habits in this habitat differ somewhat from those of the same species in Oklahoma (Bragg, 1940a). Many tadpoles were present in flowing streams upon my arrival in the region in June. They were especially abundant in the Gallinas both at Las Vegas and at Montezuma, six miles to the northwest, as well as in the Arroyo de Pecos at the eastern edge of the city. In all of these locations they occurred only in the flatter areas of the stream beds where the water was flowing with a gentle current. They were not found in spring-fed pools on the flood plains of these streams adjacent to the selected breeding sites in the main streams themselves. No tadpoles were found at any time in the muddy cattle tanks in the short-grass pastures of the region, although, basing judgment upon knowledge of the habits of *B. w. woodhousii* in Oklahoma, these were the first places investigated. Late in August, several young tadpoles were taken from shallow, clear water, grassy quarry-pools south of Romeroville. Judging from the size ranges, these had come from three clutches of eggs laid at different times, two of them in one pool,

the other in an adjacent pool. Other than the frequent light showers, there had been no rain since August 6, and the tadpoles were too small to have been produced on or near this date. Males were heard calling all along irrigation ditches as well as in the Gallinas during several nights in June when there had been no significant rain. On the other hand, none were seen or hard about suitable breeding sites after an 0.80 inch rain on July 12 or after heavy rain on August 5 and 6, both of which brought out Scaphiopus in large numbers (see beyond). *B. w. woodhousii* was never found breeding, nor any evidence of its having bred, in roadside ditches in this region.

These observations confirm two conclusions drawn from a study of these toads in Oklahoma (Bragg, 1940a); (1) that they breed more or less independently of rain and (2) that this is a very adjustable and versatile species whose habits are not so fixed that they cannot be changed considerably in adaptation to various habitats.

(3) **Pseudacris triseriata** Wied. This little hylid was found on one night only, breeding in considerable numbers in grassy, clear-water, shallow pools after the rain of 2.04 inches on August 5 and 6. Many males, a few females, and one clasping pair were taken in one place on the north edge of the city, a very few from the edge of another flooded area nearby; and one calling male from an overflow of a ditch four miles to the south. The clasping pair produced a few eggs in the laboratory but these did not develop. Thorough sampling of these pools with a dipnet at two different times later failed to reveal tadpoles. It seems probable that, of the many presumably produced, most fell prey to the predaceous larvae of *Scaphiopus bombifrons* which were very numerous in the pools.

(4) **Scaphiopus hammondii** Baird. I wish to emphasize that the western spadefoot occurs abundantly about Las Vegas. It is not limited to California and areas immediately adjacent as implied by Stejneger and Barbour (1939). It bred twice during the summer, first during the evening of July 12 after a downpour of 0.80 inch in one-half hour late in the afternoon and again, on the night of August 6, after just over two inches of rain. Both times, many eggs were laid and tadpoles developed in many pools, every one of them muddy and temporary in nature.

The voice of this species has been adequately described by Ortenburger (1924) as like the loud purr of a cat but with the metallic sound of grinding gears. It is quite different from that of the closely related *S. bombifrons* and any experienced person upon hearing the two species calling together could not possibly mistake the one for the other. The

reactions of the males in securing mates also differ from those of *S. bombifrons*. According to Trowbridge and Trowbridge, 1937, (and often confirmed by my own observations), the male of the latter species calls with little moving about, apparently depending upon the call to attract the female. In contrast, the male of *S. hammondii* swims actively while calling (cf. Ortenburger, 1924) and investigates any other spadefoot that comes near. Ten different times I watched two males swim actively toward each other, meet head on and struggle for the clasping position. In each case, when one has been successful, the other uttered its breeding cry within a few seconds, whereupon it was released immediately. Since none were released before uttering the call, it seems probable that voice plays a part in sex-recognition in this species. I was not successful in seeing a mating between a female and male.

These differences in the calls and in the mating behavior confirm the results of Smith (1934) and of Tanner (1939) who concluded, principally upon differences in the bony structure at the top of the head, that *S. hammondii* and *S. bombifrons* are specifically distinct. The specific status of these two forms is further confirmed by the constant differences in their tadpoles (Smith, 1934; Bragg, 1941), those of *hammondii* having a prominent beak and notch in the jaws and overdeveloped jaw-muscles, whereas those of *S. bombifrons* lack these structures.

(5) **Scaphiopus bombifrons** (Cope). The plains spadefoot appeared in numbers, breeding in all sorts of temporary pools of both muddy and clear water, during and after the rains already mentioned in July and August. Whereas *S. hammondii* appeared only upon the nights immediately following the rains. *S. bombifrons* called in diminishing numbers for two nights after the rain in July and for three nights in August. Most of the eggs were laid during the first night in each case, however. A small chorus was also heard and individuals seen during the afternoon of August 6 in a deep roily ditch wherein eggs had been laid during the rain the night before.

These facts do not support the common idea that *S. bombifrons* appears but once during a season to breed (cf. Trowbridge and Trowbridge, 1937); and it adds one more to the comparatively few records of these spadefoots having breeding activities in the daytime.

Breeding of both species of spadefoots was observed in many different pools. Some of these contained only *S. bombifrons*, others had only or mostly *S. hammondii*, and still others had about equal num-

bers of each species. I could find no probable reason why this should be so.

In one pool which was very extensive but exceptionally shallow and very muddy, *Scaphiopus bombifrons* bred alone both in July and in August (determined not only by calling males but also by the tadpoles later collected). The eggs produced here in July were not seen but those laid in August were produced in an exceptional manner. Each egg in more than fifty masses found was on a stalk of jelly almost exactly like those figured by Ortenburger (1924) for the eggs of *S. hammondii* in Arizona, except that the egg-masses were smaller. There were often as few as ten or twelve eggs in one mass and seldom more than thirty, the masses close together near the bank and fixed to very low vegetation at the edge of the water. Each egg was attached separately to a plant so that the stalk did not occur on the edge of a jelly-mass as is indicated by Wright and Wright (1933) that they sometimes may be. This is probably the result of the smallness of the masses produced. Since other small masses of eggs of this species have been found which did not have stalks, both in New Mexico and in Oklahoma, and since no eggs observed in other pools have had this appearance, it seems probable that the stalked eggs were produced as a result of some factor or factors in the environment rather than some property intrinsic to the organisms. I have no idea as to what this factor may be; but it should be noted that this pool was very much more shallow (nowhere more than two to four inches deep) than I have ever before seen used by *S. bombifrons* for breeding.

As was observed by Gilmore (1924) for one of them, tadpoles of both *S. bombifrons* and *S. hammondii* vary much in developmental rates, even in the same pool. They also have an independent difference in average size at the same age in different pools. The variation in size of individuals in a single pool is more marked in *S. hammondii* but the difference in individual sizes in any two pools is more noticeable in *S. bombifrons*. Seventy-one tadpoles of the latter species from one pool varied between 13.0 and 39.0 mm. in total length about an average of 27.4 mm., whereas thirty-five of the same age from another pool were just entering metamorphosis at an average length of 45.6 mm. with a range of 42 to 51 mm. Since it was noted that, in general, the deeper the pools, the smaller the tadpoles, a temperature factor may explain the differences of average sizes of tadpoles of *S. bombifrons* taken at the same age from different pools. This will not explain the individual variations noted in the same pools for this species

nor the much greater variations noted for *S. hammondii,* some individuals of which have a developmental rate so fast, when compared with that of their sisters of the same age and in the same pool, as to be truly remarkable.

In most pools observed carefully, the numbers of tadpoles of *S. hammondii* (but not of *S. bombifrons*) were comparatively fewer than expected on the bases of calling males previously noted and of eggs seen. Because of this and also because tadpoles of *S. hammondii* are known to be cannibalistic, I am inclined to interpret the individual differences in developmental rates as an adaptation, some individuals forging ahead of their fellows in development and feeding upon them. I have no direct evidence that this is the case, however, and I have no idea as to how such favored individuals might be produced.

Twenty-one larvae of *S. bombifrons* were reared through metamorphosis and kept for about three weeks in a pail of moist sand to note their behavior, especially as regards feeding. They were fed daily (often several times a day) upon small insects and spiders. Their reactions and food were essentially as described by Trowbridge and Trowbridge (1937), with the following exceptions and additions. They were often out in the daytime and some individuals burrowed only when direct sunlight fell upon them or when the surface of the sand was allowed to become dry. In the early morning, nearly all would be out. In late afternoon, a few of the larger individuals were always in evidence. In feeding, some were more aggressive than others and these grew at a faster rate. The following types of organisms were eaten at least once (some many times): gnats, small flies, small ants of several species, (large ones were offered but never eaten), thrips, collembolans, leaf-hoppers, aphids, several types of small beetles, crab-spiders, and other small spiders. Individuals of a species of small black ant were once taken by each of two of the larger toads, whereupon the toads hopped frantically about, clawing at their mouths, and thereafter refused to attack this insect. These small toads gave no evidence of negative phototaxis but remained active and feeding under an electric lamp. This observation is like that of Trowbridge and Trowbridge (1937) and differs from the findings of Smith (1934). However, as the Trowbridges noted, it does not follow that the behavior in captivity necessarily is the same as in nature.

(6) **Rana pipiens pipiens** (Schreber). The common leopard frog was the only Rana found in the region. It was very abundant along the water-courses and around all of the larger temporary pools and ditches to an elevation of at least 6,800 feet; but neither it nor

its tadpoles occurred in and about the beaver ponds in the higher reaches of the Gallinas Valley, nor was it found in the alpine pools higher in the mountains. Most of its tadpoles were found in the permanent water of the region, principally because its breeding season had passed before the temporary pools had formed during the present season. Its tadpoles were found in one shallow quarry-pool, however. One adult specimen and several larvae, were presented to me from Chimayo, Rio Arriba County, by their collector, Mr. Ezequiel Sandoval.

In view of the question as to how many species of frogs of the *pipiens* group should be recognized in North America, the following characteristics of this form may be of interest: This frog had already bred upon my arrival in June, its tadpoles metamorphosing from late June to mid-July. I found no real evidence of its breeding after June 6 although one mated pair was seen on the bank of a temporary pool during a warm afternoon in mid-August. As contrasted with the common leopard frog of central Oklahoma, it did not call after the rains in July and August while Scaphiopus was breeding, as could have been expected of the Oklahoma form; it was relatively easy to catch by hand in the daytime, something which is decidedly not true of the Oklahoma form; and it seldom emitted a call as it plunged to the water when alarmed, something very characteristic of the common frog of Oklahoma. Structurally, it is a short-headed (or at least not a long-headed) type, and it does not usually have the white spot in the center of the tympanum, a characteristic of its Oklahoma counterpart.

While differences in characteristic behavior are of no help to a taxonomic worker with a series of alcoholic specimens before him, these differences should be taken into account whenever possible. After observing the two forms in the field, I feel certain that the frog about Las Vegas, New Mexico is very similar to, if not identical with, the grass-frog of New England (*Rana brachycephala* of the recent checklist) and the leopard frog of Wisconsin and different from that of Oklahoma which I call *Rana sphenocephala* (Cope).

SUMMARY

In summary, one Bufo, one Rana, one Pseudacris, two Scaphiopus and one Ambystoma apparently constitute the amphibian fauna of the Las Vegas region. The Bufo and Rana typically breed in the springtime, the Rana before the Bufo, if one may judge from this one sea-

son's observations. The Pseudacris and both species of Scaphiopus breed following rains later.

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TWO NEW SPECIES OF APHAENOGASTER (HYMENOPTERA: FORMICIDAE)

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The worker of each of the 33 previously described forms of *Aphaenogaster* occurring in the United States is characterized by a pair of epinotal protuberances commonly known as "spines." These may vary from well-defined spines in some species to structures which might more properly be called tubercles in other species. *Aphaenogaster mutica,* described by Pergande from Lower California and listed by Wheeler at present at Terlingua, Tex., has a worker in which these structures are greatly reduced but are nevertheless present as a pair of very short but distinct tubercles. Recently I have seen two undescribed species in which the tubercles are so vestigial that they can be detected only by the most careful examination. One of the species is from Florida, the other from Arizona.

The tubercles on the Florida worker are so feebly developed that they can be seen only under high magnification (61.2 times), whereas those of the Arizona form are scarcely more evident. Although the worker of each species has a slender body and slender appendages, a head greatly narrowed posteriorly, and large and proturberant eyes, I believe both species should be referred to the subgenus *Attomyrma* Emery rather than the subgenus *Deromyrma* Forel, since in each case there is lacking the remarkable collar-like constriction of the posterior part of the head, and the very pronounced, reflexed occipital flange characteristic of *Deromyrma.*

The two forms may be distinguished as follows:

Anterior surface of petiolar node, in profile, almost in the same plane as that of the dorsal surface of pedicel; postpetiolar node long, low and moderately convex; Florida.....*floridana*, new species

Anterior surface of petiolar node, in profile, meeting the dorsal surface of the pedicel in a very pronounced, obtuse angle; postpetiolar node short, rather high, and strongly convex; Arizona.....*boulderensis*, new species

Aphaenogaster (Attomyrma) floridana Smith, n. sp.

WORKER.—Length 4.5–5 mm.

Head, excluding mandibles, one and one-fourth to one and one-

half times as long as broad; including mandibles, subelliptical; much broader anteriorly than posteriorly; sides very strongly converging posteriorly behind the eyes. Occipital flange present but weakly developed. Mandible large, elongate, triangular, the masticatory border with four prominent apical teeth, and a numbr of smaller and less distinct basal teeth. Clypeus approximately twice as broad as long, convex, with a very feeble emargination in middle of anterior border. Eye prominent, strongly convex, with approximately 15 facets in its greatest diameter; about one and one-half times its greatest diameter from base of mandible. Antennal scape slender, long, approximately one and one-fifth times as long as head not including mandibles; noticeably enlarged toward apex. Dorsal surface of prothorax and anterior half of mesothorax, in profile, forming a regular but not strongly convex arch. Posterior half of mesonotum weakly depressed. Mesoepinotal constriction distinct, not so deep as broad. Base of epinotum feebly convex, distinctly longer than declivity and meeting declivity in an obtuse angle; epinotal tubercles so feebly developed as to be visible only under high magnification (61.2 times). Petiolar node about one and one-fourth times as long as pedicel; anterior surface of petiolar node, in profile, so weakly declivous that the dorsal surface of the pedicel and the anterior surface of the petiolar node appear in almost the same plane; posterior surface not strongly convex, slightly longer than the anterior surface and meeting the latter at an angle of approximately 90 degrees. Postpetiole about one-third longer than broad; from above, sides subparallel throughout the posterior half and converging in the anterior half; postpetiolar node, in profile, longer than high, low and moderately convex. Legs long and slender. Gaster from above elliptical.

Frontal area, posterior part of head, prothorax, anterior part of mesothorax, petiole, postpetiole, and gaster rather smooth and shining. Antennae and tibiae opaque. Mandibles finely striated. Cheeks and region of head anterior to eyes with a few small, longitudinal rugulae. Head, except for areas mentioned, mesothorax, and epinotum with granulation-like shagreening.

Hairs yellowish, sparse, suberect to erect, moderately long on head, thorax, petiole, postpetiole, gaster and ventral surfaces of the coxae, trochanters, and femora. Appressed hairs on antennae and legs short but fairly abundant and conspicuous.

Light yellowish brown, with slightly lighter mandibles and clypeus.

Type Locality.—Gretna, Fla.

Described from two workers, holotype and paratype, collected July

15, 1906, by A. W. Morrill. Both, in the collection of the United States National Museum, bear U. S. N. M. No. 55660.

No information is available concerning the biology.

Aphaenogaster (Attomyrma) boulderensis Smith, n. sp.

Worker.—Length 4.5–5.5 mm.

Head, excluding mandibles, one and three-tenths to one and four-tenths times as long as broad; sides appearing somewhat subparallel up to the posterior border of each eye, from which points they very gradually converge to form rounded posterior corners and a rounded occipital border; occipital border with a weakly developed flange. Mandible large, triangular, with approximately 8–10 teeth of variable size. Clypeus about twice as broad as long, with a rather distinct emargination in middle of anterior border. Frontal carinae subparallel throughout almost the posterior half of their length. Eye prominent, strongly convex, with approximately 15 facets in its greatest diameter; eye about one and one-half times its greatest diameter from base of mandible. Antennal scape slender, long, about one and one-fourth times as long as head, not including mandibles. Dorsal surface of prothorax and anterior third of mesothorax, in profile, forming a regular but not strongly convex arch. Posterior two-thirds of mesonotum noticeably depressed, in profile forming a rather straight line. Mesoepinotal constriction distinct, broader than deep. Base of epinotum feebly convex, meeting the declivity at an obtuse angle; vestigial tubercles scarcely more evident than those of *floridana*. Petiolar node distinctly longer than pedicel; anterior surface, in profile, meeting dorsal surface of pedicel in a very distinct obtuse angle; dorsal surface of petiole somewhat rounded, as is also the sloping posterior declivity, the two areas ill defined at the point where they merge into each other. Postpetiolar node scarcely longer than high, anterior surface forming a long slope, posterior surface more convex, declivous and short. From above, gaster subelliptical, broader than head.

Frontal area, posterior part of head, prothorax, anterior coxae, dorsal surface of petiole and postpetiole, and the gaster rather smooth and shining. Anterior two-thirds of head, including mandibles, the antennae, and tarsi, more opaque; mandibles somewhat coarsely and longitudinally striated. Clypeus and genae longitudinally rugulose, the former bearing a distinct median carina; frontal area with one or several longitudinal rugulae. Mesothorax, epinotum, and under surfaces of petiole and postpetiole with granulation-like shagreening;

epinotum also finely and transversely rugulose. Coxae, femora, and gaster with exceedingly fine reticulae.

Hairs yellowish, moderately long but sparse, suberect to erect, on head, thorax, petiole, postpetiole, coxae, trochanters, gaster, and also on ventral surfaces of femora. Antennae, tibiae, and tarsi with short, appressed hairs, these especially abundant and noticeable on the antennae.

Light yellowish brown, often with darker mandibles, anterior portion of head, antennae, legs, and gaster.

Type Locality.—Horseshoe Island in Mead Lake of the Boulder (Ariz.) Dam.

Described from 21 workers, collected May 2, 1941, by Professor Vasco M. Tanner. Holotype and 13 paratypes in collection of the United States National Museum bear U. S. N. M. No. 55661. The other seven paratypes are in the collection of Professor Tanner.

Professor Tanner stated that the ants were collectd from beneath a "lava rock, on the top of Horseshoe Island."

New Bird Records from Zion National Park

During the past few months bird observations in Zion National Park have added new species to the park list. In addition, records of more than usual interest were obtained for other species known to occur within the park. All of the following records are for 1941:

On January 31, the second winter record of a Hermit Thrush *Hylocichla guttata ssp?* was obtained when one was noted in Oak Creek Canyon. This bird stayed around the small stream and adjacent slopes for several days.

On April 25, a male albino woodpecker was observed in Pine Creek Canyon. For some time the bird was followed to learn more regarding its identity. Finally it was joined by a female White-breasted Woodpecker *Dryobates villosus leucothorectis*, and both birds then moved on up the slope together. The male bird was entirely white except for a red crown patch, dark bill and very light gray wings. I was not able to get close enough to definitely determine the color of the eyes.

On April 30, while following up Parunuweap Canyon, a Western Sandpiper *Ereunetes mauri* was found along the stream. Although I covered over four additional miles of the river, no others were noted. This constitutes the first record of this bird from Zion.

The Western Lark Sparrow *Chondestes grammacus strigatus* was listed by Presnell (The Birds of Zion National Park, Proc. Ut. Ac. Sci., Arts & Letters, 1935) as being a rather uncommon summer visitor in the canyons. However, on July 20 a pair of Lark Sparrows were observed feeding young near the residential area in Oak Creek Canyon. This is the first breeding record of this bird in Zion and definitely establishes the species as a summer resident.

On October 18, while in Refrigerator Canyon en route to Angels Landing, I obtained the first record of the Western Goshawk *Astur atricapillus striatulus* for the park. The hawk was in rapid pursuit of a small bird which managed to escape in a dense grove of evergreens. No effort was made to flush the bird from the trees, the hawk apparently knowing that such a task would be fruitless.

As additional studies are made, especially seasonal studies in the higher reaches of the park, new and valuable data should be uncovered that will go far toward clarifying the status of many species in this area that is now obscure.—Russell K. Grater, Park Naturalist, Zion National Park.

Antarctic Birds Contributed by Dr. Russell G. Frazier

A valuable collection, consisting of three species of Antarctic birds, was contributed to the collections of Brigham Young University by Dr. Russell G. Frazier of Bingham Canyon, Utah, on October 25, 1941. These birds were collected in Antarctica by Dr. Frazier while he was a member of the United States Antarctic Expedition, 1939-1941, under the command of Rear Admiral Richard E. Byrd. Dr. Frazier was one of the physicians of the expedition which sailed in the *North Star* and the *Bear* in late November, 1939, from Atlantic ports of the United States. These same two vessels brought the members of the expedition back to Boston in May, 1941. Of the 36 species of birds found in the Antarctic region, three are now represented in the Brigham Young University zoological collection. Two of the five species of Penguins, the *Adelie* and *Emperor*, and a pair of Snow Petrel, with an egg clutch which consists of one egg, makes up the collection.

The Adelie Penguin

The Adelie Penguin, *Pygoscelis adeliae* Hombron and Jacquinot, Ann. Sci. Nat. (2), p. 320 (1841, Adélie Land), is the common bird throughout the circumference of the extensive polar continent. This species never leaves Antarctica to go north of 60° south latitude. During the short summer the Adelie is busy hatching and rearing its young, while during the long winter it lives on the open sea. It begins to establish its breeding territories in October and November by selecting areas left bare by the melting snow. These breeding colonies are to be found everywhere in Antarctica from the beginning of the mating and nesting period until winter begins in March. There is evidence that the birds return year after year to the same rookeries and use the same nests. The mating pair stays together for the breeding period. Two, very rarely three, eggs are laid which are set on alternately by the male and female. Incubation lasts from about 33 to 36 days; all hatching being over by the middle of January. The down-covered young are fed fish and Crustacea by the parent birds. They regurgitate the food, which is taken from their throats by the awkward, fast-growing young birds. When the young, in March, take to the sea, to care for themselves, they have a plumage different in color to that of the parents, this they wear for a year, when by molting they get the feather coat of the breeding adults.

The Emperor Penguin

The Emperor Penguin, *Aptenodytes forsteri* Gray, Ann. Mag. Nat. Hist. XIII, p. 315 (1844, S. lat., 64° 77′ S.), is widely distributed over the whole of the Antarctic continent as is the Adelie Penguin. This beautiful bird is large in size, oftimes reaching the height of 38 to 40 inches and weighing 60 to 70 pounds. Its head is black, except that on each side there is a band of yellow that diminishes in color down along the neck. The back is bluish-gray, while the belly is a satiny white. The Emperor does not leave the polar regions, staying near the continental mass on the large icebergs. The habits of this Penguin are very different from those of the Adelie Penguin briefly discussed above. The laying of the eggs takes place in midwinter, at about the end of June, when the polar night reaches a temperature of 40 to 50 degrees centigrade below zero. The mating pairs gather on the great ice masses, lay a single egg which is kept off the ice by being placed on the feet of the Penguin and held snugly against the body of the bird. Since the incubation period lasts about two months, the egg is shifted from the female to the male during this period. Dr. Frazier has the following to say about this species:

> "The Emperor Penguin nests in rookeries around Mt. Erebus where they can secure stones for egg 'companions,' laying their egg during the midwinter night. They carry it on the top of their foot where they can hold it against a fold of skin and their lower abdomen. The matings are seasonal."

The young are hatched about the beginning of September, and towards the last of October migration towards the north begins. Groups of adult birds, with some young ones still covered with down, are carried off on small blocks of ice broken from the icebergs. The young birds lose their down in January and from that time on they shift for themselves. The adults molt before returning in June to the continental ice for breeding.

The Snow Petrel

The Snow Petrel, *Pagodroma nivea* (Gm.), Syst. Nat. I., p. 562 (1788), differs greatly from the Penguins in color and habits. This species is spotless and white with large jet black eyes, black beak, and black webbed feet. They vary in size and wing length; the male having a range from 10 to 11.8 inches, and the female from 9.8 to 11.8 inches in wing length. Their food consists of small sea organisms which they capture when skimming over the water, in the cracks and channels in the ice.

The Snow Petrel protects itself, as do most Petrels, by expectorating a fluid, which has a fishy odor, towards the intruder, the smell of which will cling to clothing for many days. This is perhaps the most striking bird of the Antarctic region. Dr. Frazier reports as follows concerning his experience with it:

> "The Snow Petrel—inhabit the Antarctic, and to the best of my meager knowledge stay within the Antarctic circle. They nest in November and December; lay one egg. The only rookery found was on Mt. Breckanridge—155° W. 77° South. The nests were found under loose laying rocks on the north exposed side of the mountain. The nests are on bare rocks, no feathers or protection from the ground. The nests are used year after year. This was determined by the ejecta on the rocks which the birds can eject from their mouths with unerring accuracy at an

enemy for a distance of four feet. By January 10th the chicks should be hatched. The egg is protected by the bird, even at the cost of her life. Their enemy is the *Skua Gull* that nests close by. The bird lives on sea life and flies great distances for its food. The rookery I found had about 100 nests."

Mr. Howard Saunders in his Antarctic Manual, p. 228 (1901), comments as follows on the range of the Snow Petrel:

"This bird has been obtained as far north as Falkland Islands, but it does not occur in any numbers until Lat. 60° S. is passed, whence it can be traced as far southward as man has penetrated. Every expedition has noticed it. Ross found it among the crevices of the cliffs at Cockburn Island; Surgeon Webster, of H. M. S. *'Chanticleer,'* met with the bird from January to March on Deception Island, South Shetland; and the German Expedition found it nesting at the end of December on South Georgia. From the Enderby Quadrant it has not yet been recorded." [1]

The Snow Petrel's habits were studied by Dr. Racovitza during the voyage of the *'Belgica.'* The following interesting extract is from his report:

"But it is better not to make too intimate an acquaintance with these lily-white beings, for then one is saved from cruel disillusions. Its voice is shrill and disagreeable, and its ways are deplorably low caste. It possesses the faculty of being sea-sick at will; and when one attempts to seize it, it discharges full in one's face the oily contents of its chest. I can affirm, from personal experience, that one does not come off with the perfume of the rose. One must add, however, to do strict justice, that it merits extenuating circumstances; for this unpleasant habit of this bird serves as a protection for its feeble person, and that is a reason of a certain value." [2]

This collection of Antarctic birds is being arranged in a habitat case just opposite a habitat group of Polar Bears. The Polar Bears are a gift from the Museum of The Academy of Natural Sciences of Philadelphia, received from Mr. Wharton Huber in 1936. The large male bear of the group was taken in North Greenland by the Perry Relief Expedition. The painted backgrounds showing the general environmental conditions along with the specimens makes valuable study groups.—V. M. T.

(1) Report on the Collections of Natural History Made in the Antarctic Regions dur- the voyage of the "Southern Cross," p. 149, 1902. British Museums of Natural History.
(2) op. cit. p. 153.

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A BIBLIOGRAPHY OF UTAH MAMMALOGY; INCLUDING REFERENCES TO NAMES AND TYPE LOCALITIES (FIRST SUPPLEMENT) [1]

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In 1936 (Proc. Utah Acad. Science, Arts, and Letters, 13: pp. 121-146) the writer compiled and published a list of the known references dealing entirely or in part with Utah mammalogy up to and including the year 1935. The present paper is a continuation of that project, including some references previous to 1935 that were overlooked in the first writing, and bringing the list up to 1941 inclusive. The bibliography for 1941 especially is probably far from complete, but such references as have come to the attention of the writer are herein included.

The same general plan of presentation adopted in the first paper is continued in the present writing. A chronological list of references, alphabetical list of types described from Utah, index to authors, and index to scientific names applied to Utah mammals.

During the past half decade mammalogical work in Utah has progressed rapidly. The period has been marked by an increased interest on the part of local workers. In the last five years there were about twice as many papers published on Utah mammals than there were in the preceding five year period. A total of about 70 papers has been added to the bibliography since 1935. Out of 74 subspecies whose type localities are in Utah, 34 or 45% have been named within the past six years.

(1) Contribution No. 96, Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

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2. *Dipodomys merriami frenatus* Bole, Sci. Publ. Cleveland Mus. Nat. Hist. 5: pp. 1-2, 1936. TYPE: Toquerville, Washington Co., May 14, 1934 (B. P. Bole).
3. *Dipodomys microps bonnevillei* Goldman, Proc. Biol. Soc. Wash., 50: pp. 222-223, December 28, 1937. TYPE: Kelton, Boxelder County, November 7, 1891 (V. Bailey).
4. *Dipodomys microps russcolus* Goldman, Jl. of Mammal., 20: pp. 353-354, August 14, 1939. TYPE: Dolphin Island, Great Salt Lake, June 5, 1938 (W. H. Marshall).
5. *Dipodomys microps subtenuis* Goldman, Jl. of Mammal., 20 p. 354, August 14, 1939. TYPE: Carrington Island, Great Salt Lake, June 30, 1938 (W. H. Marshall).
6. *Dipodomys ordii alfredi* Goldman, Proc. Biol. Soc. Wash., 50: pp. 221-222, December 28, 1937. TYPE: Gunnison Island, Great Salt Lake, June 1, 1937 (Alfred M. Bailey and Robert J. Niedrach).
7. *Dipodomys ordii celeripes* Durrant and Hall, Mammalia (Paris), 3: pp. 10-16, March, 1939. TYPE: Trout Creek, Juab Co., May 5, 1937 (S. D. Durrant).
8. *Dipodomys ordii cineraceus* Goldman, Jl. of Mammal., 20: pp. 352-353, August 14, 1939. TYPE: Dolphin Island, Great Salt Lake (W. H. Marshall).
9. *Dipodomys ordii marshalli* Goldman, Proc. Biol. Soc. Wash., 50: pp. 223-224, December 28, 1937. TYPE: Bird Island, Great Salt Lake, June 22, 1937 (W. H. Marshall).
10. *Microdipodops megacephalus leucotis* Hall and Durrant, Murrelet, 22: pp. 6-7, April 30, 1941. TYPE: 18 miles SW Orr's Ranch, Tooele Co., June 6, 1940 (S. D. Durrant).
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17. *Onochomys leucogaster utahensis* Goldman, Jl. of Mammal., 20: pp. 354-355, August 14, 1939. TYPE: Stansbury Island, Great Salt Lake, June 22, 1938 (W. H. Marshall).
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23. *Reithrodontomys megalotis ravus* Goldman, Jl. of Mammal., 20: p. 355, August 14, 1939. TYPE: Stansbury Island, Great Salt Lake, June 26, 1938 (W. H. Marshall).
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25. *Thomomys bottae convexus* Durrant, Proc. Biol. Soc. Washington, 52: pp. 159-162, October 11, 1939. TYPE: E. side Clear Lake, Millard Co., May 20, 1938 (S. D. Durrant).
26. *Thomomys bottae minimus* Durrant, Proc. Biol. Soc. Washington, 52: pp. 159-162, October 11, 1939. TYPE: Stansbury Island, Great Salt Lake, June 25, 1938 (W. H. Marshall).
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29. *Thomomys bottae wahwahensis* Durrant, Bull. Univ. Utah, 28, Biol. Ser. 3: pp. 1-7, August 18, 1937. TYPE: Wah Wah Springs, 30 miles W of Milford, Beaver County, Utah, July 22, 1936 (S. D. Durrant).
30. *Thomomys talpoides gracilis* Durrant, Bull. Univ. Utah, 29, Biol. Ser. 3: pp. 1-6, February 28, 1939. TYPE: Pine Canyon, 17 miles NW Kelton, Boxelder County, Utah, July 12, 1930 (Annie M. Alexander). (Described as *T. quadratus gracilis.*)
31. *Thomomys talpoides moorei* Goldman, Jl. Washington Acad. Sci. 28: pp. 335-336, July 15, 1938. TYPE: One mile S of Fairview, Sanpete Co., February 19, 1928 (A. W. Moore). (Described as *T. fossor moorei.*)
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6: pp. 1-6, October 24, 1939. TYPE: Settlement Creek, Oquirrh Mountains, Tooele County (S. D. Durrant).

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34. *Thomomys talpoides parowanensis* Goldman, Jl. Washington Acad. Sci., 28: pp. 334-335, July 15, 1938. TYPE: Bryan Head, Parowan Mountains, Iron County, September 8, 1908 (W. H. Osgood). (Described as *T. fossor parowanensis.)*

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A NEW ELAPHRUS (COLEOPTERA, CARABIDAE)[1]

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Elaphrus torreyensis Tanner, new species

Female: Form, robust, body more elongate than other species of this genus; color metallic green above, cupreous beneath on the metothorax, abdomen and proximal portions of the legs; tibia and tarsus dark reddish; labrum, mandibles and distal portions of palpi black; the eyes large and black; interorbital width 1.6 mm with a round central boss falling off towards and back of orbits; just back of the central boss is a depressed circular spot with deep punctures. Head, especially the depressions on the dorsal and front deeply punctured while the elevated portions and the gular area are practically free from punctation. Two pairs of setae, one pair on the lateral portion of the clypeus and the other on the median inner margin of the orbits. Antennae shorter than in the *lecontei* complex, reaching only to the posterior third of the thorax. Articles 1 to 3 and the base of fourth glabrous, while the remaining seven segments are setiferous with two long setae on each segment; the third segment the longest one, being twice as long as the second. Thorax 2.6 mm wide, with a deep hour glass shaped depression, bordered with two round depressions filled with deep punctures; the margins and humeri deeply punctured; while the elevated discal portions are finely and sparsely punctured. Elytra 4.1 mm wide, with ocellate foveae violaceous in the center and from which a setae 3/4 mm long extends; 21 ocellate foveae on the left elytron and 25 on the right one. The whole surface is sparsely and finely punctured except on the inner humeri, where they are deeply and closely punctured similar to the contigeous thoracic areas. The ventral unpunctured except on the lateral portions of the first two abdominal segments and the episterna of the thorax; the episternum of the prothorax is rather closely and deeply punctured. Total body length 10 mm.

Female Genitalia: Valvifers and coxites larger and setae not so styliform as in *clairvillei* and *olivaceus*. (Fig. I.) An examination of many specimens shows that the female genitalia have a few distinctive characters. After studying

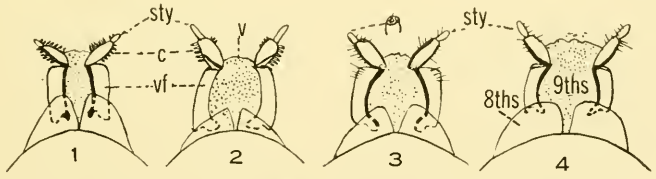

Fig. I. Female genitalia of 1. *Elaphrus clairvillei*; 2. *E. olivaceus*; 3. *E. torreyensis*; 4. *E. lecontei*. ((sty—stylus; c—coxite; vf—valvifer; v—vulva; 8ths—eighth sternite; 9ths—ninth sternite.)

(1) Contribution No. 97, Department of Zoology and Entomology, Brigham Young University.

the genital structures of eight species of this genus it was possible to separate each one by certain small differences. The genitalia of four species are illustrated in this study.

Type Locality: Torrey, Wayne County, Utah. Torrey is located on the Fremont River drainage, elevation 6,900 feet, near the west entrance to the Capital Reef Monument area. The holotype and a paratype, taken at Escalante, Garfield Co., both females, were collected by Wilmer W. Tanner in June, 1938. The holotype is in the Brigham Young University entomological collection and the paratype is being contributed to Dr. E. C. Van Dyke for the California Academy of Sciences collections. Dr. Van Dyke has been very kind in helping with the study of Utah Carabidae. I am indebted to him for two female specimens of *clairvillei* used in this study.

Torreyensis is most closely related to *clairvillei* from which it may be separated by a more robust form, size, coloration, and female genital characteristics. I have attempted to follow Col. Casey (1920-24) in his study of this genus, but find it difficult to agree with his conclusions. *E. spissicornis* from Parowan, Iron County, Utah, on the basis of specimens of *lecontei* from this and many other localities of Utah seems to be a synonym of *lecontei*. I am unable to distinguish any differences in the antennae of Utah specimens of *lecontei*. I have four specimens from Mr. F. S. Carr which he collected at Medicine Hat, Alta. (Choppice Lake) in August 22, 1927, labeled *E. devinctus* Csy., also specimens from Pingree Park, Colorado, which I am unable to separate from *lecontei*.

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